

THE IRON AGE

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What the Machine Has Done to Us

THIS is the introductory article of a series by Walter S. Giele on the "trend of mechanization" in our manufacturing industries.

Dealing exclusively with demonstrable facts, the author presents the most comprehensive picture yet published of the actual long-term interrelations of employment, wages, productivity and mechanization.

Mr. Giele's data are derived from unquestionable sources. His methods have been examined and approved by leading economists and statisticians. He has carefully and purposely avoided the danger of jumping at conclusions or setting up theories based upon partial evidence.

As a groundwork for the diagnosis and correction of the faults in our present production system, Mr. Giele's series will, we believe, represent a distinct contribution to the cause of sound thinking, especially so, since through the consideration of a complete series of facts, it effectively controverts the sketchy assumptions of Technocracy and other visionary cults.

By WALTER S. GIELE

THIS study was begun about a year ago in an effort to learn whether such data in connection with this subject as might be available and fairly considered reliable would show underlying trends and, if so, whether such trends could reasonably be related to each other and to current events.

At that time and, in large measure, up to the present a great deal of the discussion of the current depression seemed to be centered around a theory that this depression is no ordinary manifestation of the phenomenon of the business cycle, but that it is a wholly new situation resulting from conditions unprecedented in human experience and that it definitely marks the end of an era.

The particular phase of the situation that has, perhaps, been most discussed has been the mechanization of manufacturing industry. Most of this discussion of mechanization in manufacturing industry either starts with or arrives at the conclusion that machines have displaced men with two-fold effect; first, vastly increased productive capacity resulting in over-production and second, vastly de-

creased buying capacity resulting in under-consumption, the two, of course, interacting, each to aggravate the other.

Vastly decreased buying capacity has, in general, been held to have resulted from a decreasing share of the proceeds of production distributed as wages. Thus the wage earner has been held to have been thrown out of employment by decreasing consumption, ending his own ability to buy and leading in turn to a progressive and cumulative effect as more and more wage earners find themselves with less and less buying power so that more and more other wage earners are unemployed by the consequent reduction in consumption.

A preliminary survey of the situation suggested a number of angles of approach.

First, basic trends might have been obscured by surface manifestations and old phenomena in a new environ-

ment might assume new aspects, without fundamental change.

Second, the time element may have been a major or an incidental factor. Sequences of events and combinations of causes may have conditioned each other by reason of their relative timing. Secular trends and cyclical variations, each separately well established, may have been imposed, one on the other, in an unusual if not wholly new combination. Present events may not be the results of present causes but the results of the accumulated aggregate of many causes, some of which might reach back for a considerable distance in time.

Third, manufacturing industry is but part of our vast and complex economic structure and social life.

Mechanization in manufacturing industry is therefore but a part of the broad picture of mechanization in our lives. Employment in the manufacturing industries is only a part of the broad picture of the population as a whole earning its living by engaging in some form of gainful occupation.

The money wage and the real wage which affects living conditions and

social status are only a part of the perspective of the economic and social structure.

The Material

Material available for the study of the problem is to be found in the carefully prepared data of the Bureau of the Census, United States Department of Commerce, and of the Bureau of Labor Statistics, United States Department of Labor, as well as many private sources, business annals, newspapers, magazines, and so forth.

Very complete data covering substantially the entire modern industrial history of this country are available from these sources on:

Total population, showing rate of growth.

Distribution of population by age groups showing employability—and dependency.

Distribution of population by marital condition, showing employability and occupation of women not listed as gainful.

Distribution of population by environment, showing availability for agricultural or non-agricultural occupation.

Distribution of population by occupational groups, showing shifts in character of occupation.

Wage earners employed in manufacturing industry.

Wages paid to wage earners in manufacturing industry.

Primary horsepower capacity installed in manufacturing industry.

Value of industrial production.

Value added by manufacture.

Index of commodity prices at wholesale.

Index of the cost of living.

Annals indicating historical backgrounds of events as they occurred.

Method of Approach

The method of approach is by comparison of rates of change on a ratio basis largely by means of charts.

Any change is significant only with relation to the base from which it starts and in relation to other changes which it may effect or by which it may be affected.

In a dynamic aggregate of which the only constant is the constant condition of flux in all of its components, both with respect to each other and for each with respect to its own prior conditions, relative changes are significant in terms of the rate at which they occur.

Changes in dissimilar quantities, as in numbers of men and numbers of dollars, are comparable only in terms of their relative rates.

Relative rates can be compared only by isolating the elements, studying their separate rates of change and then relating those which have a bearing on each other.

Having thus developed the relative rates of change, the net results may be appraised in the light of established fact.

Outline of Steps in Analysis

It is proposed, after having set forth the general method of analysis, to outline the steps in sufficient detail

to enable the reader to check the computations or to extend them as additional and later data become available.

The general method of analysis used will be that of visualizing the magnitudes of the quantities involved and their relative changes and rates of change by means of graphic representation on charts.

The logarithmic vertical scale is used in plotting the magnitudes with the arithmetic horizontal scale for plotting the time intervals, a form commonly known as the ratio chart.

Thus the progressive changes in the magnitudes of any single series plotted can be visualized in terms of relative or ratio increase or decrease with respect to time, and the slopes of the lines serve to visualize the rates of change.

If the line is straight, then the rate of change is in simple geometric progression, i.e. increasing or decreasing by a uniform percentage or ratio with respect to time. If the line is ascending and concave upward, then the magnitudes represented are increasing at an accelerated rate and each increment of magnitude for an equal time interval is not only greater than the preceding increment but represents a larger percentage increase. That is, the rate of change is faster and ever faster. This is a relation that must be carried in the background of the mental image when visualizing the rates of change in quantities of such widely dissimilar magnitudes as are involved in this analysis, as, for instance, in picturing population growth over a period of 80 years.

If the line is ascending and convex upward, then the magnitudes represented are increasing at a retarded rate. This is the characteristic of the time series which are subject to the law of diminishing return. The curve becomes more and more nearly horizontal and is said to "flatten out".

If the line is descending and concave upward, the magnitudes represented are decreasing at a retarded rate, that is, more slowly with each time interval.

If the line is descending and convex upward the magnitudes represented are decreasing at an accelerated rate and the movement may, in colloquial language, be pictured as accumulating momentum, that is, the opposite of diminishing return.

If, then, two or more series are plotted on the same chart, it is very easy to visualize their relative rates of change, with respect to time and with respect to each other in their true significance even though the series represent quite dissimilar things as, for instance, persons and dollars.

As the logarithmic vertical scale implies, vertical distances on the chart are proportional to the logarithms of the magnitudes they represent, just as on a slide rule the graduations are

proportional to the logarithms of the numbers marked on the scale.

When, therefore, two series are plotted on the same chart, the vertical distance between points on any time ordinate represents the difference between the logarithms of the quantities represented, or the quotient resulting from the division of one by the other; that is, the ratio of one to the other.

Such divisions are accomplished mechanically by stepping off the distance with dividers in a process analogous to the setting of a slide rule. The ratio may be reversed; that is, expressed in terms of reciprocals as the distances are stepped off upward or downward, and multiplications may be accomplished by addition instead of subtraction of distances.

Rates of change in geometrical progression are indicated graphically on the ratio chart, the ratio which each term bears to the next following in the progression being represented by the angle between the "curve" or the trend line and the "X" axis.

Thus, on the chart, we may select any two points "A" and "B". The tangent of the angle at "A" is $\frac{a}{b}$ when "a" represents the vertical height of "B" above "A" and "b" represents the corresponding horizontal distance on the "X" or time axis.

Since the vertical distances are on a logarithmic scale "a" becomes $\log B - \log A$ and the tangent is

$$\text{therefore } \frac{\log B - \log A}{b} \text{ or } \sqrt[b]{\frac{B}{A}}$$

which is the formula for finding the constant ratio between the terms of a geometrical progression when any two terms and the number of terms between them is known.

Elements and Relations Compared

To establish an historical background against which this whole picture may be projected, an historical chart has been prepared with the events recorded so arranged that they will correspond in spacing with the time scale of the other charts, which will follow in the succeeding articles. In this way the historical chart may be set opposite any of the other charts and the varying changes in magnitude and rates may be related to the events with which they were coincident. It is to be kept in mind, however, that coincidence does not of necessity imply a causal relation.

The component parts of the picture will be separately shown and related on the charts in the following manner:

1. Employment and Wages

This will show, first, the broad view of the entire population and its growth, then subdividing the population as a whole into its groups as they relate to employment and employability with respect to age, marital condition, environment, and occupa-

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His practical experience in the management of mechanized industry has been noteworthy. He has been works manager and designer of the Stoever Foundry &



Mfg. Co.; works manager and special engineer of the Harrison Safety Boiler Works; president and general manager, Lebanon Gear & Machine Works, and director, Meadville Malleable Iron Co. Mr. Giele has been in consulting practice for some years and has officiated as receiver in reorganization or liquidation of a number of important manufacturing properties.

In addition to his preliminary academic and professional training and his subsequent activities, Mr. Giele has studied corporate finance and business cycles at New York University and the University of Pennsylvania.

tion. The number of wage earners employed in manufacturing industry is then isolated from the total employment of all those engaged in gainful occupations, and on the same chart on which is shown the total number of wage earners employed in manufacturing industry is the total amount of dollar wages paid to these wage earners, so that it is thus possible to compare the rates of change in the numbers of wage earners so employed to the total wages paid to these same wage earners, and to derive the average annual earnings per wage earner, and in turn to readily compare the variations in the rates of change in such average annual earnings with the rates of change of numbers of wage earners and dollars paid.

2. The Price Level and the Cost of Living

This will show, first, the variations in the index of wholesale commodity prices over the long period of years covered, together with the rates of change, that is to say, the rapidity with which prices have risen or fallen during this period, thus making possible a comparison in terms of the changing purchasing power of the dollar unit. Second, the cost of living is shown in relation to the annual dollar wage per wage earner, thus making possible a comparison between the money actually received by the wage earner and the relative quantity of commodities he has from time to time been able to buy with that wage; that is to say, his real wage in terms of his living.

Certain supplemental charts will be shown in connection with these charts, depicting on a larger scale relations between cost of living (involving retail prices of goods and services) and wholesale commodity prices. These

supplementary charts show the relative response in point of magnitude of the retail and wholesale prices involved and indicate the measure to which the index of wholesale prices may be applied where cost of living data are not available on a comparable basis.

3. Mechanization and Investment

Charts are shown depicting the horsepower capacity of prime movers installed in manufacturing industry at the various census periods, compared with the number of wage earners employed in utilizing this horsepower capacity, which makes possible not only a comparison of the rates of growth of these factors, but also makes possible the derivation of a curve depicting the average horsepower capacity per wage earner, and its relative rate of growth. A chart is also prepared showing the other side of the same picture; that is to say, the total primary horsepower capacity installed in manufacturing industry compared with the index of the physical volume of production as distinct from the pecuniary volume of production. The fluctuations in the price level are such that the pecuniary volume would in itself give no indication of the relation between application of power to the processes of manufacturing industry and the physical volume produced. The comparison on this chart makes possible the derivation of a curve representing the horsepower per unit of physical volume, which is a measure not only of the mechanization of manufacturing industry, but also of that part of the investment in manufacturing industry actually applied to manufacturing.

Supplementary charts will be shown representing estimates of money investment in manufacturing industry.

These are supplementary charts by reason of the fact that it is very difficult to allow for the changing volume of the dollar unit, and also exceedingly difficult, from the data available, to separate that portion of the investment of any enterprise or groups of enterprises devoted specifically to manufacturing as such from the portion of investment devoted to other activities of the same enterprise, such as distribution.

4. Physical Volume and Productivity

Charts will be shown depicting the dollar volume of production in the manufacturing industries and also the dollar volume of value added by manufacture. The definition of the Bureau of the Census is that the value of the product is the aggregate of the amounts for which it is sold by the manufacturer while the value added by manufacture is the money for which the product is sold less the sum of the items of cost of materials, of fuel, and purchased electric energy.

Comparison of these two curves on the same chart visualizes the relation between the total value of the product and the value added by processing in the manufacturing plants.

In this connection also will be shown a chart on which is derived a measure of these volumes on a per wage earner basis by comparison with the curve of the number of wage earners employed in the industry studied.

Charts will also be shown exhibiting the value of the product and value added by manufacture in comparison with the wholesale price index, from which comparison is derived a curve which is a measure of physical volume and which can be compared with the index numbers of physical volume derived in other ways, as a cross

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1857 The canal building boom collapsed following the speculative excesses which had begun in 1829. Every bank in the United States closed and six States repudiated public debts. Depression lasted five years.

1849 In the California Gold Rush supplied cheaper money with which to discharge debts contracted in dear money.

1849 The first of the country's two great railroad panics fell on the rising industries of the North but left

check. These charts also make possible a comparison of value of product and value added by manufacture on a dollar basis, and on physical volume basis with total wages per wage earner, total horsepower, and total horsepower per wage earner.

5. Hours of Labor and Hourly Rates

A chart will be shown exhibiting the total wages paid to all wage earners in manufacturing industry on an annual basis, and the index of average hourly wage rates makes possible the derivation of a curve showing an index of the total average hours annually worked by the wage earners in earning these wages, establishing a trend which is an index of the average annual hours of labor worked by the wage earners in all manufacturing industries.

6. Finally, the component parts having been shown separately, a study will be presented of the inter-relations and the effects of the changes and rates of change of these component parts on each other, to be covered essentially by a comparison of:

- (1) Real wages with productivity
- (2) Mechanization (or investment) and productivity
- (3) Mechanization and employment
- (4) Wage earners' share of the sales dollar
- (5) The wage earner's producing power compared with his buying power, and
- (6) The effect of mechanization on working conditions, living conditions, and hours of labor.

Historical Chart

Referring to Chart 1, accompanying this introductory article, even a very casual reading of the events as they are recorded with the passage of the years and of the generations will at once impress the reader with the remarkable repetition in regulated cyclical order of almost the same sequence of events, varying only in the setting of the times in which they occurred. In fact, if the dates and names were removed and the cards were shuffled, it would be extremely difficult to rearrange the events in their chronological order, so closely do they follow each other in typical characteristics. Thus we find in 1829, more than a hundred years ago, a rapidly growing and widely extended country in which transportation was the great need most in the public mind. Accordingly we find in the canal building boom of that era an expansion of investment in capital equipment such as has found expression in response to changing needs generation after generation since that time. We find that the speculative excesses which came with that boom resulted in 1837 in a collapse during which every bank in the United States closed and six States repudiated their public debts, resulting in a depression which lasted five years. This depression, which in the environment of its day must surely have been comparable in its tragic effects with the severe depre-

sion through which we are now passing, was, however, soon forgotten. By 1857, only 20 years later, the canal had been succeeded by the railroad as a vehicle for the expansion of capital investment and the excesses of the then very recent past resulted in another collapse. The country was swept by the first of its two great railroad panics, in this case falling almost entirely on the rising manufacturing industries of the North and leaving the agricultural South practically untouched. The inequality of economic welfare served to intensify the growing misunderstandings between two great sections of the country, separated by diverse economic interests. This inequality of economic status probably overshadowed any differences over the questions of secession and of slavery and fanned the flames which were even then kindling the first sparks that were later to blaze out in the Civil War.

Civil War Prostrates Industry

In 1861, the conflagration swept the country—a struggle which was to last four bitter years. Little can we of this day, recalling the disruptions of an external war, picture the chaos of internal war. The South was deprived of the manufactured products of the North. The mills of New England were deprived of the cotton of the South. Every tie on which depended financial and commercial relations was torn asunder. Transportation was blockaded. Men on both sides left their businesses to join the combat. All peace-time activities gave way to the necessity for munitions of war. The end of the struggle found a nation prostrated though united. The South found itself not only impoverished by destruction of man power and of property but with its entire social and economic structure collapsed.

Eighteen hundred and sixty-six was, nevertheless, marked by active business in the United States, with full employment of labor at increased wages. The recuperation from the war was rapid and the six years from 1867 to 1873 constituted a period of expansion in industry and transportation during which 30,000 miles of new railroads were built. This expansion in railroads alone doubled the entire mileage that had been in service in the country in 1860.

While commodity prices were falling from their war time peaks, wages rose and physical volume of production increased. The iron trade was unusually prosperous. Speculation was active and railroad stock prices were on a high level. Industry was not greatly affected by the financial panic of "Black Friday", Sept. 24, 1869.

The Panic of 1873

In 1873, the third week in September brought a financial panic accompanied by an industrial crisis which "left the country's financial and

commercial structure almost in ruin". . . . "The most serious weakness was disclosed in connection with railroad building. . . . Before the crisis construction had had to wait upon the slow sale of bonds or the venturesome advances of bankers, and after the crisis construction had to be discontinued altogether, leaving a large mileage connecting nothing in particular." The crisis, which came as a surprise to the business community, was preceded by the failures of the New York Warehouse & Security Co. and the banking house of Kenyon, Cox & Co. Other failures followed, among them that of the well-known house of Jay Cooke & Co. The prices of securities fell violently, the New York Stock Exchange was closed for ten days, clearing house loan certificates were issued throughout the country, and the banks restricted or suspended currency payments. Real estate, wholesale prices, then retail prices and finally wages declined.

The currency had been over-inflated, railroads were over-built, over-trading and extravagance were general on every hand. Cities and corporations had rising budgets and there were many scandals in the management and financing of railroads, banks and insurance companies. Thus the depression wore on with alternate hope and despair, apprehension and restored confidence. Finally, with a record volume of production in manufactures, minerals and crops and a good market abroad, the tide of the five-year depression was turned in 1878.

In 1879, specie payments were resumed, restoring confidence and accompanied by a rapid rise in commodity prices (though, as will appear later, the underlying price trend was still downward). The United States was still predominantly agricultural and a huge grain crop with high prices had a buoyant effect on the production of minerals and of manufactured goods as well.

In 1882, storm clouds again began to gather and 1883 was marked by many failures, a depression in the iron trade and declining prices. Foreign confidence was shaken and by 1884 there was a pronounced outward movement of gold, and foreign capital which had been invested in the enthusiasm of the post-war reconstruction period began to be withdrawn. A long series of important failures was followed by serious labor troubles.

By 1887, the atmosphere had again cleared, railroads had been reorganized and railroad building resumed on a grand scale. The crop situation improved and prices were good. Tremendous construction programs were supported by an influx of British capital and the circulation of national bank notes was contracted through government debt reduction.

Currency difficulties, however, were working toward an acute situation of

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1857 The California Gold Rush supplied cheaper money with which to discharge debts contracted in dear money.

1857 The first of the country's two great railroad panics fell on the rising industries of the North but left the South untouched, thus helping to split the country prior to the Civil War.

1849

1859 1865 The Civil War.

1867-1873 Six years of expansion in industry and transportation during which 50,000 miles of new railroads were built. For comparison, total miles in operation, 1860, 50,000 and 1870, 52,000.

1869 1873 Introduced a panic beginning a long period of declining values. Securities fell first, then real estate, wholesale prices, retail prices and wages. Currency had been over-inflated, railroads over-built; over-trading and extravagance was general, cities and corporations had rising budgets, there were scandals in railroads, banking and insurance. Period of deflation and struggle to resume specie payments.

1878 Crop failures elsewhere created demand for American products and turned the tide of the depression.

1879-1882 Specie payments were resumed.

1882-1885 Heavy gold exports and foreign capital withdraws.

1886-1889 Tremendous railroad construction and influx of British capital. Contraction of Bank notes through Government debt reduction. Currency saturated with silver and difficulties becoming acute.

1890 Silver currency legislation, foreign capital withdrawal, deficits in federal revenue, depletion gold fund.

1893 Panic which lasted five years. Gold outflow, business and bank failures, 156 railroad receiverships.

1894 Reorganization plans, temporary revival. 1895 Increased outflow gold.

1896 Foreign liquidation and outflow gold. More railroad receiverships. Sentiment improved with McKinley's election. 1897 Rising prices. 1898 Spanish-American War. High production in mining and manufacturing industries.

1900 Gold standard enacted. McKinley reelected. World wide rise commodity prices. Era of consolidations.

1906 United States Steel Corporation reissues dividends. Railroad dividends are increased.

1907 Eight money. Legislation against corporations and railways. No market for bonds. Banks fail.

1908-1909 Acute panic passed. Rail baiting continues. Payne-Aldrich tariff enacted. A decade of bumper crops and of high aggregate value of crops.

1910-1912 Roosevelt splits Republicans. Wilson elected. Dissolution many corporations. 1913 Federal Reserve Act.

1914 War panic. Stock Exchange closed. Gold exports. 1915 War orders. 1916 Anglo-French loans.

1917 We declare war. British war loan. I and II Liberty Loans. War Finance Corporation. Treasury certificates of indebtedness were issued and foreign credits were extended. Armistice signed in November.

1919 Victory loan, wage increases, and strikes. Largest crop value. 1920 Gold outflow, rail wages increased.

1921 Price declines, wage reduction. German mark collapses. 1922 Wage Reductions. 1923 Wage, price increases.

1924 Coolidge elected. Heavy financing. High farm product prices stimulate industry.

1925 # wheat, England returns to Gold Standard. Large security issues. 1927 Building active. Grain high.

1928 Hoover elected. Increased mail order and steel sales. Large foreign and domestic bond issues.

1929 Wages increases. Farm Relief Legislation. Large domestic stock issues. Stocks collapse.

1930 Large domestic and foreign bond issues. German loan, Austrian loan. Security prices again collapse. Note—Adapted from chart of Statistical and Chronological Records, 1875-1930, prepared under direction of Warren M. Persons, for Barron's, "The National Financial Weekly," and other sources.

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"silver saturation" by 1890, and the passage of the "free coinage" silver bill in 1891 disturbed sentiment here and abroad. A new outflow of gold and withdrawal of foreign capital followed. A high aggregate value of crops, combined with unfavorable crop conditions abroad, was a bright spot but deficits were accumulating in the Federal revenue and the "gold redemption fund" was being depleted. The Homestead strikes occurred in 1892. The Reading Railroad bankruptcy occurred in February, 1893. The outflow of gold early in the year led to the announcement by the Secretary of the Treasury that Treasury Notes would be redeemed as long as he had gold "lawfully available for the purpose."

There followed a panic punctuated by a series of disastrous failures of

banking and commercial houses. There were, in a single year, 156 railroad receiverships, including such important roads as the Lake Shore (now part of the New York Central System), Erie, Northern Pacific, Union Pacific and Atchison.

In 1894, as had occurred in the 1870's, hope revived, railroad reorganization plans were announced and the Government's financial position improved. The year was, however, marked by the gravest of labor difficulties, including the bitter Pullman strike and the widespread strike of the American Railway Union. Federal troops were sent into Illinois to control the situation. Coxey's army of unemployed marched on Washington.

In 1895, the outflow of gold again increased and the Government reserve was decreased.

In 1896, there was renewed liquidation of foreign holdings and a further violent outpouring of gold. The Baltimore & Ohio and other important companies went into receivership and business sentiment was generally unsettled by Bryan's free silver campaign. McKinley's election in November brought improved feeling and business began to pick up. The long commodity price decline which had begun in 1866 ended in 1896, and 1897 saw rising prices and a large export demand for grain.

The War with Spain

In 1898, the tension over the Cuban situation culminated with the blowing up of the Maine in Havana harbor and the declaration of war with Spain on April 25. Mining and manufacture were further stimulated by the psychological effects of military successes and of abundant agricultural crops.

In 1899, the American Steel & Wire Co. and numerous other large corporations were organized, inaugurating "big business."

In 1900, the "gold standard" was enacted and McKinley was reelected. Prices were good but there was a serious strike in the anthracite mines and the iron and steel industries were depressed.

In 1901, the United States Steel Corp. was organized and there were a number of large bank and railroad consolidations. A world-wide rise in commodity prices was gaining impetus and production was high.

In 1903, labor troubles had become graver in many parts of the country and Colorado strikers were placed under martial law.

In 1904, United States Steel passed its dividend and strikes continued in many industries, though the steel industry had some stimulus from foreign business as the year progressed. Theodore Roosevelt, of "Rough Rider" popularity, having previously succeeded to the Presidency at McKinley's death in 1901, was elected. Crops were abundant and crop prices high.

"Trust Busting" Begins

In 1905, "trust-busting" activities began with investigations and orders to distribute holdings. Wage rates continued to advance. Charles Evans Hughes exposed life insurance scandals.

In 1906, United States Steel resumed dividends and some of the railroads increased theirs. Labor difficulties were adjusted and laws regulating corporations, pure food and meat inspection were enacted. Crops reached a new record aggregate value.

The year 1907 brought extensions of investigations and of suits hostile to railroads and other corporations. Judge Landis fined the Standard Oil Co. \$29,240,000. There was no market for corporate or municipal bonds and there was a wave of important fail-

(Continued on Advertising Page 16)

THIS chronological chart of economic events is reproduced to the exact time scale which will be used in the factual charts in Mr. Giele's succeeding articles. It may, therefore, be superimposed upon them as an aid to the interpretation of cause and effect.

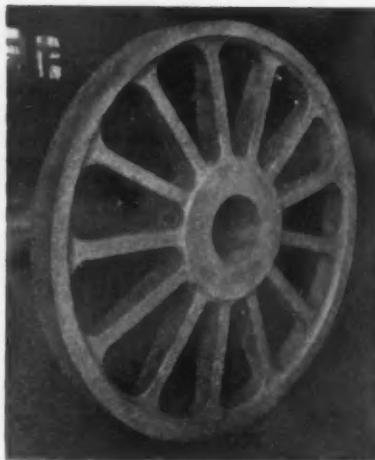


Fig. 1.—General appearance of one of the locomotive wheel centers.

LOCOMOTIVE wheel centers, cross-heads and other castings subjected to severe shocks and stresses are purchased by the railroad companies under specifications calling for high physical properties, which until recently have made necessary the use of expensive alloy steels.

Some of the railroads have been content to specify only the physical properties required, leaving to the manufacturers' preference the alloy to be used. Other companies specify the alloy to be used as well as the physical requirements, and various alloy steels have been tried in service, including nickel, chrome-nickel, chrome-vanadium, etc. The physical properties called for by these "alloy" specifications vary with the different railroad companies, but the great majority will fall within the ranges shown in the following tabulation:

Ultimate tensile strength,	85,000 to 95,000 lb. per sq. in. min.
Yield point . .	55,000 to 60,000 lb. per sq. in. min.
Elongation in 2 in.	22 to 25 per cent
Reduction of area	40 to 50 per cent

Quenching in a liquid medium was formerly forbidden with the result

New Heat Treatment for Carbon Steel

that annealing, or at best normalizing or normalizing followed by a draw heat, has been the rule for castings made under these specifications. All of the "alloy" specifications set up maximum allowances for phosphorus and sulphur contents, which are quite generally 0.05 per cent. One company establishes 0.045 per cent as the allowable maximum for both elements, while another company permits 0.06 per cent of sulphur with 0.05 per cent phosphorus. Welding of minor blemishes is sometimes permitted, but only in localities not subject to stress, and then by special permission of the railroad companies' inspection departments. Needless to say, inspection for castings made to these specifications is exceedingly rigid.

During the last year or so, the railroad companies have been considering the use of carbon steel castings, heat treated by quenching and drawing, to meet the physical requirements of the "alloy" specification. This was considered to be quite a radical departure from existing practice, and occasioned a great deal of discussion between the foundries and the engineers and designers of the railroad companies. Several foundrymen of experience expressed the opinion that carbon steel could not be heat treated to meet these specifications, and also that the design and size of wheel centers, cross-heads and the like would make the quenching of such castings an extremely hazardous operation.

Several months ago one of the largest and most progressive railroad companies placed an order with the

A NEW departure in the heat treatment of carbon steel castings for railroad locomotives is described in this article. The treatment involves quenching in water followed by drawing—a practice hitherto not permitted by the railroads for such castings. The adoption of this method was considered a radical departure. Details of the practice and equipment used and the high physical properties obtained are given.

Bonney-Floyd Co. of Columbus, Ohio, for large wheel centers for high-speed electric locomotives to be made of carbon steel, heat-treated by quenching and drawing to meet the following specification:

Ultimate tensile strength.	85,000 lb. per sq. in.
Yield point	55,000 lb. per sq. in.
Elongation in 2 in.	22 per cent
Reduction of area	40 per cent

For several years the Bonney-Floyd Co. has been advocating the use of heat-treated alloy and carbon steel castings and has installed modern heat-treating furnaces, quenching tanks and handling facilities which are essential if heat treatment is to be successfully carried out. The railroad company, in search of a dependable source of supply for castings of this character, thoroughly inspected the molding machines, melting and heat-treating furnaces and other equipment at the Bonney-Floyd plant before placing the wheel center order.

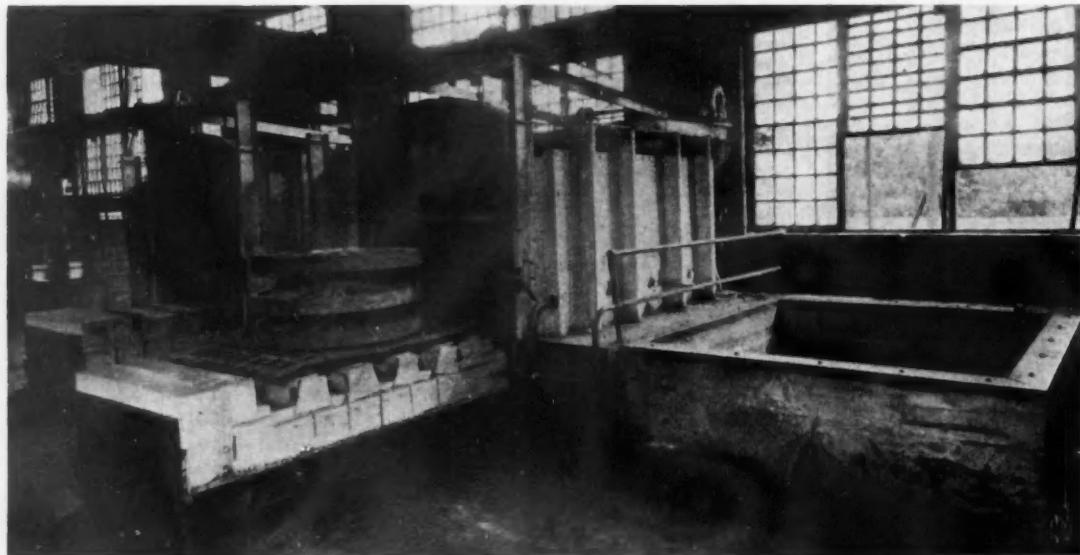


FIG. 2.—The heat-treating furnaces and the quenching tank.

Carbon Steel Locomotive Castings

By A. W. GRECC

General Superintendent,
The Bonney-Floyd Co., Columbus, Ohio

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One of these wheel centers is shown in Fig. 1. The overall diameter in the rough is 56 in., the diameter of the hub is 18 in. There are 13 arms which are 2½ in. at the top and taper to 1½ in. at the bottom. The face of the rim is 5 in. and the weight of the casting is 1650 lb. in the rough. Coupons were cast on the hub and rim of each casting to be used for the test bars. The steel was made in an acid electric furnace of 3-ton per hour capacity. Three wheel centers were made per heat which also constituted a heat-treating furnace charge. The chemical composition of the steel was as follows:

	Per Cent
Carbon	0.28 to 0.35
Manganese	0.85 to 0.90
Silicon	0.35 to 0.45

The average phosphorus content on all heats made for this order was 0.037 per cent. The average sulphur content was 0.030 per cent. Only four heats showed over 0.04 per cent phos-

phorus and only two heats over 0.035 per cent sulphur.

All castings were quenched in water and drawn (or tempered). The furnaces used are shown on Fig. 2. The quenching tank is shown at the right. Three wheel centers are shown on a tray resting on the piers of the furnace car. The tray is handled from the furnace to the quenching tank by an overhead crane carrying a semi-automatic latch which prevents delay in picking up the hot load. It is possible to have the castings in the quenching tank in 40 sec. from the time the door is opened.

Movements of door and car are motor driven and controlled by push buttons operated either from the floor or from the crane cab. The furnaces are gas-fired and controlled by recording automatic pyrometers. The temperature control equipment is shown at the left of the illustration. The design of the furnaces is such as to insure circulation of heat above and below the load and extremely uniform temperature throughout.

Coupons for test bars were broken from castings after being stamped with the serial number of the wheel and the railroad company's inspection mark. Test bars were pulled by the railroad's testing laboratory and also duplicates were machined and pulled at the manufacturer's plant. The average results of all the tests pulled for the order, representing 47 heats and 94 test bars, is shown below:

Ultimate tensile strength...	94,020 lb. per sq. in.
Yield point.....	69,480 lb. per sq. in.
Elongation in 2 in.....	26 per cent
Reduction of area.....	61.0 per cent

The Brinell hardness results averaged 180 and the company which machined the castings reported them unusually uniform and readily machinable. Steel of this character shows 40 to 45 ft. lb. on the Izod machine.

It will, of course, be understood that the physical characteristics of 0.30 per cent carbon steel can be varied to a remarkable degree by variation in the method of heat treatment. The tabulation below shows approximately the limits for physical properties, between which limits these properties may be varied by changing the temperatures employed:

0.30 Per Cent Carbon Steel Possible Variation

Ultimate tensile strength	from 80,000 to 128,000 lb. per sq. in.
Yield point	from 55,000 to 100,000 lb. per sq. in.
Elongation in 2 in.....	from 30 to 8 per cent



Fig. 3.—Appearance of one of the wheel centers after the drop test.

Reduction in area.....from 63 to 16 per cent
Brinell hardness number.....from 167 to 253
Izod impact test, ft. lb.....from 50 to 14

Before starting production on the order three sample wheel center castings were made and machined to determine solidity at all points. These castings were submitted for inspection to the railroad company's testing department. Because castings of this size and type had not been previously furnished in a heat-treated condition, the railroad company's engineers decided to conduct a drop test on the sample castings as follows: They desired the castings to show no signs of fracture when struck three times on the hub by a 5-ton ball falling 20 ft. with the rim supported at three points on a solid foundation.

The drop test was conducted at the manufacturer's plant by the engineers of the railroad company's testing de-

(Concluded on Advertising Page 18)



Fig. 4.—A second wheel center which was subjected to three blows on one side of the hub.

MAGNETOGRAPHIC AND X-RAY TESTS OF PIPE WELDS COMPARED

THE work outlined in this article was undertaken as part of a general research being conducted on non-destructive test and inspection methods. At present, the program is being extended to include the examination of certain of these methods for locating defects commonly occurring in cold-drawn and hot-rolled steel bars, billets, sheet bar, plate, and seamless and electric welded tubing.

The tremendous growth of interest in welding and its applications, at-

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tended in some instances by skepticism and doubt as to its efficacy or safety, has aroused widespread interest in methods which, in advance, give promise of revealing something of the soundness of a weld's structure. In particular this is true where the welds in question are to be subjected to critical or unusual conditions of ser-

vice. It was, therefore, decided to confine the first portion of this work to the examination of outstanding non-destructive test methods as applied to certain classes of welds.

Selection of Methods

Three representative methods were selected, the sonic, as exemplified by the stethoscope; the magnetographic, and the radiographic. The stethoscope at present is receiving a great deal of vogue and is finding particular favor in the case of welded structures where other non-destructive test methods may be, and usually are, either difficult or impractical. The value of the radiographic examination of welds is well established and by now has amassed a considerable literature. Most of this literature has pertained to the X-ray and its technique. Recently, however, the results obtained by Dr. R. F. Mehl and his coworkers at the Naval Research Laboratory in the field of Gamma ray radiography give promise of great value. [THE IRON AGE, May 21, 1931.]

In the case in hand, it was felt that, so far as results with this method were concerned, they would be little more than a duplication of the X-ray work; and, as facilities for the latter are somewhat more convenient, it was selected for the present purpose. X-ray equipment used for this work was the G-E type recently installed at the plant of the Union Switch & Signal Co., and used by their courtesy.

The magnetographic method, though old in principle, is somewhat newer in application, and the work of Major Hoke and more recent developments and study by Dr. A. V. de Forrest [THE IRON AGE, May 14 and Sept. 17, 1931] and T. R. Watts have aroused general interest. Procedures adopted were along the lines developed by these men.

Test Specimens

Specimens for examination were made by courtesy of the Power Piping Co., of Pittsburgh, at its plant, and consisted of circumferential welds and welded risers on standard 4-in. lap weld pipe. Both gas and electric welds were used, and in some places they were intentionally made faulty, the



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— 3 —



— 4 —



— 5 —

FIG. 1.—Examination details of electric welded riser (Specimen No. 1, side A). No. 1 is original appearance of Specimen 1-A; No. 2 is faulty weld as indicated by Magnaflux; No. 3 is X-ray photograph showing lack of fusion; No. 4 is section taken through center of riser, and No. 5 is the preceding section (No. 4) cut in half.

EXAMINATION of outstanding non-destructive test methods as applied to certain types of welds was the aim of the investigation reported in this article. Three representative methods are included: the stethoscopic, the magnetographic and the radiographic.

Differences in welds were detected by the stethoscope. Not only good and bad welds were differentiated but faulty areas were located by the magnetographic test. The X-ray gave a more exact indication of the nature and extent of the welds.

location of the faults being unknown to any one except the welder who did the job.

On completion of the non-destructive tests, all pieces were sectioned by saw-cuts and smoothed by file and emery cloth. They were then given a light nitric acid etch and photographed. Unimportant portions, well removed from the weld area, were cut by torch.

Test Results

As a comparison of similar types of welds, preliminary tests made with the stethoscope revealed differences in note pitch and clearness, indicating real difference in structure between

Examination by the magnetographic method at once revealed areas of local fault in certain welds, as evidenced by disturbances in the magnetic field produced by passing a strong magnetic flux at right angles to the axis of the weld. (Circular magnetization was also tried, but results were inferior to the bi-polar method.) These disturbances were easily located in two ways—one by dusting uncoated "Mag-



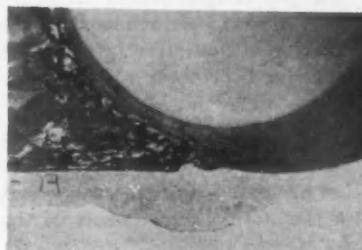
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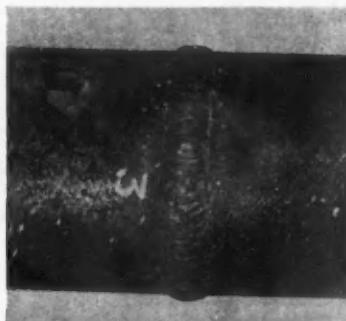
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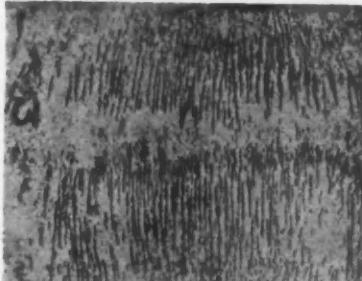
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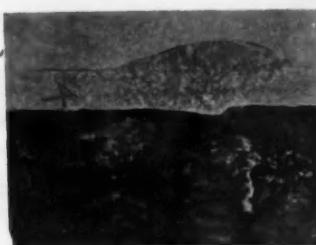
FIG. 2.—Examination of gas welded riser (Specimen 2, side A). No. 6 shows original appearance of Specimen 2-A; No. 7 is sound weld indicated by Magnaflux; No. 8 is X-ray photograph revealing sound weld, and No. 9 is etched section showing sound weld.



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— 16 —



— 17 —

FIG. 4.—Examination of circumferential gas weld (Specimen 4). No. 14 shows original appearance of specimen; No. 15 is a magnetograph which shows no serious distortion of pattern, indicating sound weld; other sections of this weld showed an even more uniform pattern; No. 16 is an X-ray photograph which indicates an acceptable weld, and No. 17 is a section showing sound weld.

▼ ▼ ▼

radiographs, received confirmation when the welds were sectioned.

The formation of ridges at faulty points is due to the development of local polarity effects. Local poles thus formed are dependent on a number of factors, such as intensity of the magnetizing field, extent, character and depth of the flaw, and shape, size and permeability of the analyzing particles. Under normal conditions, most of the above variables are removed, and appearance of the pattern is largely the resultant of two of them, namely, nature and depth of the flaw.

In the accompanying figures patterns obtained with uncoated Magnaflux were made directly on Van Dyke paper and printed. Obviously, the others were made by direct photography.

Further non-destructive examination of these specimens was conducted by the X-ray. As shown in the fig-

ures, indicated lack of fusion in various areas was confirmed, and certain localized porous areas were also revealed. In the case of all pictures shown, films were placed on the inside of the specimens, which convenient length made possible. Other pictures, not shown, were made by placing film on opposite side of the pipe, thus including in the field both front and back walls. These pictures can be taken at a direct right angle, superimposing both sides, and flaws on both front and back wall will be perfectly apparent, or they can be taken from an acute angle, separating front and rear for individual examination. In all cases, only the customary screening precautions were taken to avoid scattering of the secondary rays.

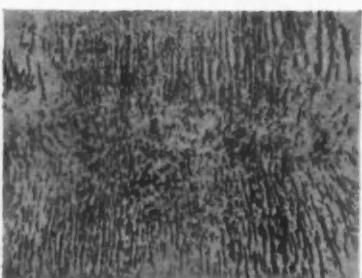
Conclusions

Differences in welds were detected by the stethoscope. In general, there was agreement between faulty indications and actual findings with the welds examined, which were, however, too few in number to warrant general deductions. Efforts to locate faulty areas in a given weld were not conclusive.

The magnetographic method promptly not only differentiated between good and bad welds, but localized faulty areas.

The X-ray, in addition to localizing faults, gave a more exact indication of their nature and extent, and differentiated between lack of fusion and porosity.

These methods are all available to those who are interested in non-destructive examination of the underlying structure of welds, and it is felt that no one method at present gives promise of replacing the others and that each has its own valuable field of application.



— 15 —

"naflux" powder on a sheet of white paper held over the weld, as shown in Figs. 3, 4 and 5, or by dusting coated Magnaflux powder on the weld and adjacent parts and tapping or blowing to remove excess. In the latter case, a white ridge is retained at or near the flaw.

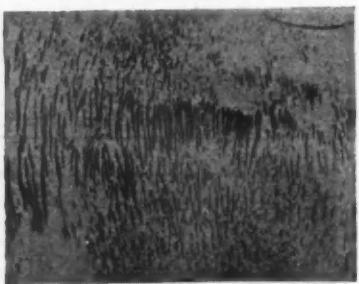
Fig. 1 shows these ridges indicating flaws in the weld structure. In Fig. 2, the corresponding photograph of another welded riser shows but slight retention, indicating a sound weld underneath. These indications, strengthened by the X-ray



— 18 —

FIG. 5.—Examination of circumferential electric weld (Specimen 5). No. 18 represents original appearance of specimen; No. 19 is a magnetograph which indicates a crack and a bad local fault; No. 20 is an X-ray photograph showing crack and bad fault at one end, and No. 21 is a section showing lack of fusion.

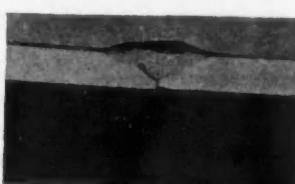
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— 21 —



Cutting off a wing of the ingot

An entirely new method of casting ingots has been developed by the Firth-Sterling Steel Co., McKeesport, Pa., after three years of research and experimental work. The process consists in casting in a cloverleaf-shaped mold, in cutting off the three wings, and discarding the central portion. Ingots weighing 1000 lb., 2000 lb., 3000 lb. and 10,000 lb. have all been cast with excellent results. To date over 300 tons of tool steel have been manufactured by this process in a number of different grades and tried out experimentally at the mill and by actual use in the field.

Method of Casting

The molds are of the dimensions shown in the accompanying sketch. There is a slight taper in the length of the ingot to facilitate stripping. Both large-end-up and large-end-down practices have been used without any noticeable change. The large-end-down practice is, of course, much sim-

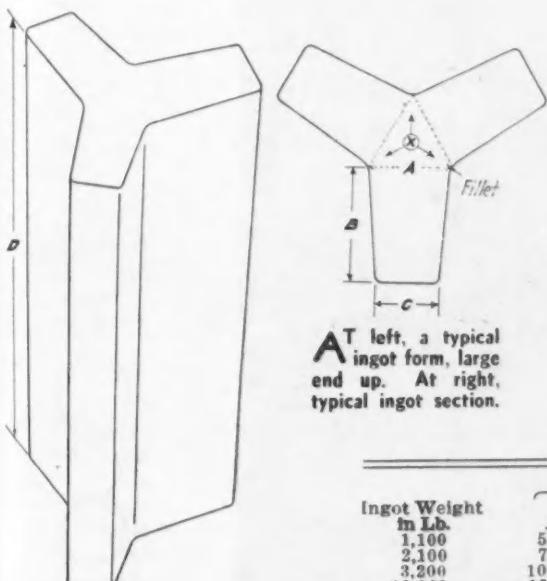
pler in that stripping can be easily accomplished. A small hot-top brick is used through a circular hole above the central triangular portion of the ingot, but this may be replaced by a triangular shaped brick. The ingot is top-poured in the regular way, the tips of the three wings being closed and appreciably below the level of the metal when the hot top brick is filled. As the ingot solidifies the last portion to cool is obviously the triangular portion at the center. This acts as a feeder for the wings, which, when cooled, are absolutely solid from the outer edge to the point of contact with the triangular center. It will be noted that the percentage of material allowed for the brick top is less than is customary in square or flat ingots. This is probably largely due to the fact that the greater chill surface per unit of area in this type of mold compared with square and flat molds causes less relative contraction after pouring has ceased. It has been noted that there is a very considerable

shrinkage inward of the wings, causing the ingot to loosen itself in the mold and thereby taking up much of the contraction which in some other types of mold has to be taken care of from within by liquid metal.

Oxy-Acetylene Torch for Cutting

As soon as the ingot is solid, the mold is stripped off and the ingot laid down sideways. A small machine carrying an oxy-acetylene cutting torch fed horizontally by a screw mechanism is placed in position and the cutting started. The temperature at which the ingot is cut depends on the grade of steel and the size. Since most tool steels are allowed to go cold anyway, the optimum temperature can be used. All carbon steels, oil-hardening and low alloy steels can be cut this way quickly and cheaply. It requires about 53 cu. ft. of oxygen to cut off the wings from a 2000-lb. ingot. The amount of gas used is approximately one-tenth the amount of

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At left, a typical ingot form, large end up. At right, typical ingot section.



Wings and discard of a 5-ton ingot after completion of cutting.

Ingot Weight in Lb.	In Inches					Discard (X) Per Cent of Total Ingot Weight
	A	B	C	D	Fillet Radius	
1,100	5 1/4	8	5 1/4	26	2	10.5
2,100	7 1/2	11 1/4	7	30	2 1/2	10.9
3,200	10 1/4	12 1/4	9 1/4	30	2 1/2	13.3
10,000	18	16 1/2	12	59	3	13.5

Unique Forming and Welding Op

TWO new methods of manufacturing rear axle housings for automobiles have been developed by the Midland Steel Products Co., Cleveland, which recently started production of housings by the new methods for some of the leading automobile manufacturers. The housings are fabricated from welded steel tubing formed by a new continuous automatic tube-making process. A method of expanding one end of the tubing, the first step in forming the banjo section, has been devised that is a unique development in forming metal. Without this step the process of making the housing from tubular stock could not have been perfected.

The methods of welding the tubing and of expanding the tubing after it is formed required the design and building of special equipment. Other notable features characterize the manufacturing details, such as various applications of welding methods and the use of special welding equipment.

Housings of certain sizes, it is claimed, can be made more economically from the welded tubular stock than by other methods, for the reason that there is a saving in material costs and reduction in scrap loss and in tool costs. The housings also are to be stronger and better designed than those made by other methods. Tubing produced by the new tube-welding equipment is claimed to be as strong as seamless tubing and to be made cheaper than the seamless tubing.

Manufacture of the housings starts

with hot-rolled strip steel as it comes from the mills in coils. It is formed into tubing in a newly designed tube-forming and welding machine in which the atomic arc welding process is used in closing the seam. The tubular stock is cut to length after welding and the pieces then move progressively through the various forming and welding operations until they reach their finished form.

The method of welding makes it possible to weld the hot-rolled strip as it comes from the mills without pickling and without the usual shearing of the edges for welding purposes. The tube-welding apparatus consists of an unique hook-up of welding arcs in a single welding head, having six pairs of electrodes spaced $1\frac{1}{4}$ in. apart and providing almost a continuous arc. Control equipment for the welding head is located on a balcony at the side of the machine. It was furnished by the General Electric Co. The welding unit was designed and built by the Midland company.

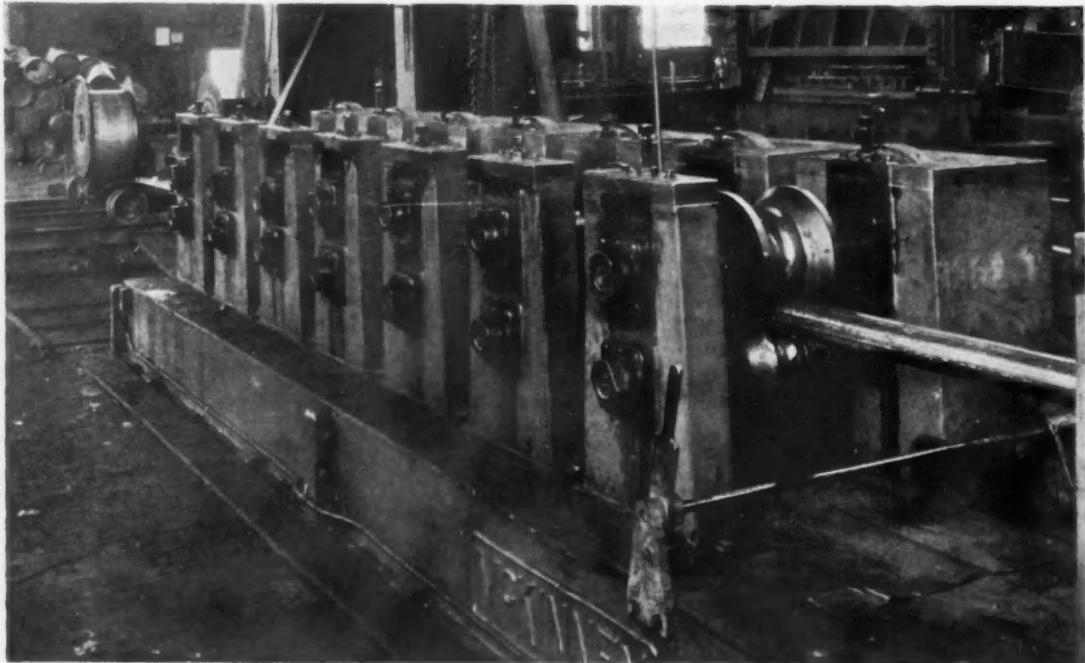
With the atomic arc welding method that is employed a welding seam is formed from the parent metal of the tubing, thereby obviating the necessity of depositing fusible filler metal with the base metal. The use

of the atomic hydrogen process was adopted because it was determined that a battery of closely disposed atomic hydrogen arcs gives exceptionally good results since contamination of the metal in the weld is largely prevented by the protective shell of hydrogen. As a result a welded seam is formed which is highly ductile, possesses a high elastic limit and is free from slag, oxides and other impurities, making the weld of purer metal than the parent metal in the tube. The weld produced after being subjected both to rigid tests and to the sequence of the forming operations required in the manufacture of axle housings have proved, it is claimed, that the tubes thus welded are admirably suited to withstand the severe forming operations to which they are subjected.

The tube-forming machine was developed in cooperation with the McKinney Tool & Mfg. Co., Cleveland, by which it was built. It has a capacity for making tubing from 2 to 5 in. in diameter with a maximum wall thickness of $\frac{1}{4}$ in. Tubing is being produced on this machine at the rate of 14 ft. per min.

The machine, in addition to the welding equipment, consists of two units mounted on one base, one for

TUBE forming unit of the continuous automatic tube forming and welding machine used by the Midland Steel Products Co., Cleveland, for manufacturing steel tubing for automobile axle housings. Coiled strip steel is formed into tubing by passing through a series of seven sets of rolls and after leaving the last pair of rolls the formed tube is carried forward under a welding head.



Operations

forming and the other for sizing and straightening. It is also provided with automatic cutting off equipment. There are seven sets of driven rolls for forming. The coil of strip mounted on a reel back of the machine is gripped by the first pair of rolls and, as it is drawn through each successive pair of rolls, it is formed cold into a tube. Each pair of rolls does a small amount of forming so that the metal is never put under an unduly heavy strain.

Back of the forming rolls and directly in front of the welding equipment is a set of idler rolls which guide the tubes beneath the welding apparatus. In the center of the top idler roll is a disk through which the edges of the formed tube pass. The function of the disk is to open the closed edges of the tubes sufficiently to permit the arc to fuse the entire thickness of the metal along the two edges.

As the tube is fed into the welding arc the edges of the cleft are rapidly reduced to a molten state, forming a long, narrow pool of molten metal. After fusion the tube is sized by passing through a pair of side rolls and a pair of vertical rolls. Back of the latter is another pair of horizontal sizing rolls, heavier and more powerful, that give the tube its final size and roundness.

Leaving the last sizing rolls the tube passes through six pairs of rolls, one set of pinch rolls and five pairs of straightening rolls. From these rolls the tube enters the cutting-off mechanism which consists primarily

By F. L. PRENTISS
Cleveland Editor, The Iron Age

of a circular housing having a reciprocating movement, through which the tube passes. At the front end of the housing are vise jaws and at the back end are three rotary cutters which are driven in a circular path around the outside of the tube. The tube strikes a stop set for a predetermined length of cut from a minimum of 30 in. and the cutting head moves forward a few inches. Then the vise jaws grip the tube and the head is carried along 16 in. further at the same speed as the tube. During this travel the tube is cut off. Then a cam releases the cutters and grip jaws simultaneously and trips an air valve that causes the cutting head to return to its original position. This head is adjustable for handling tubes of various sizes.

Air for operating the cutting-off head is supplied by a double acting cylinder. On one side there is a full air pressure of 80 to 90 lb. per sq.in., which causes the head to return quickly to the original position. The other cylinder carries through a reducing valve a pressure of 50 to 60 lb., which aids the tube in pushing the head along on its slides. With the use of the air cylinders the head becomes almost a floating member. The cutters are driven by a vertical motor above the head through a worm and worm gear. A built-in pump supplies a constant stream of water on the cutters, which otherwise would become hot from the heated tube. The tube-forming machine is driven by a 50-hp. variable speed motor, allowing a variation of speed of production depending on the size of tubing.

A VERITABLE blazing of trails characterizes the methods that have been developed by the Midland Steel Products Co., Cleveland, in the manufacture of automobile rear-axle housings. One housing is expanded from welded tubes which the company itself makes from hot-rolled strip formed and arc welded on its own machines, and a second form of housing starts with flat blanks. The whole manufacture is an outstanding example of what can be done with specially designed machinery and bold applications of the advances in welding. The suggestion value to the metal trades of what the Midland company has done is very high.

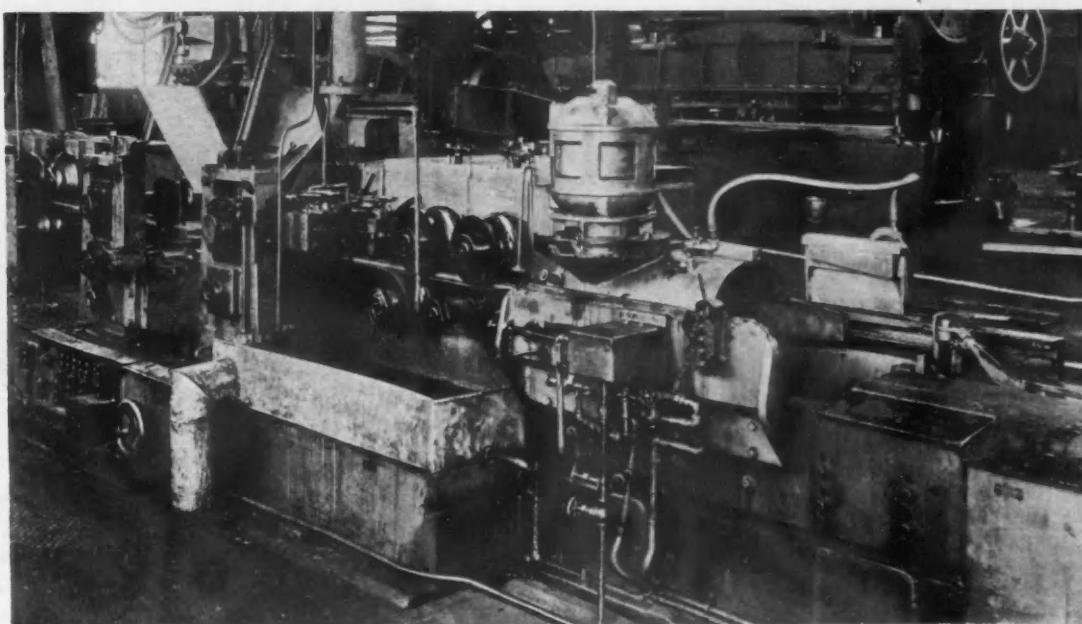


The tubular stock produced by the tube machine is ready to be manufactured in rear axle housings up to certain sizes as well as for making other products. Most axle housings used at the present time may be made of welded tubes with 5/32 to 3/16-in. wall thickness and approximately 3% in. in diameter, which, it is stated, is the smallest diameter stock that when made by this process will give the best results. The diameter of the tube used is determined by the size of the banjo section of the axle housing.

How Each Tube End is Expanded

As the tubes are cut off they are loaded upon trucks on which they are transferred to the forming department where the housings are developed. The first operation is the expansion of a section near one end. The end of the tube is heated to forming temperature and the tube is then

LEAVING the last set of forming rolls at the extreme left the tube moves through a set of idler rolls which guide it beneath the welding head having six pair of electrodes closely spaced, virtually providing a continuous arc. The atomic welding process is used in forming the seam. After welding the tube passes through sizing rolls and then into a reciprocating cutting off head equipped with rotary cutters which cut the tube to length.



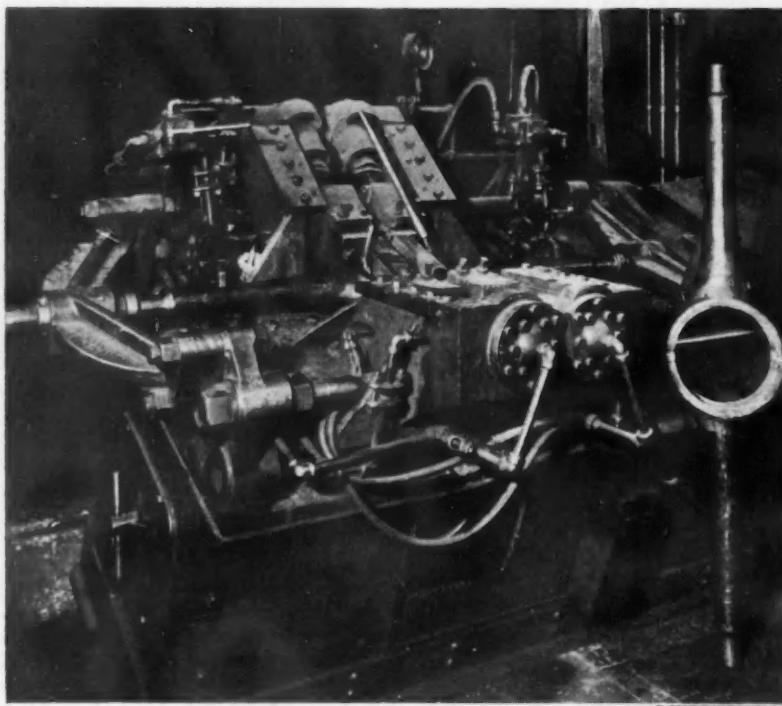
slipped over an arbor attached to the base of a punch press. This arbor swivels to an angle for convenience in loading and also to allow the use of a press of lower height than would be required were the tube placed over the arbor if the latter was in a fixed vertical position.

The tube, after being mounted over

be slightly thickened. The increased diameter at one end of the tube is necessary for the formation of the enlarged banjo portion of the housing, and, as the strength must not be decreased, it is imperative that the wall thickness be maintained, for otherwise the strength would be impaired. The expanding is done at one

to drawing operations, reducing the diameter at that end. This operation causes a lengthening of the tube and an increase in wall thickness, thereby producing a section capable of carrying the load of the automobile and of withstanding vibrations and torsional strains to which the housing is subjected while in service.

The next step in making the housing is forging a heavy bearing retainer and brake apron flange on the thickened end of the tube. This requires difficult hot metal forming operations which are done in four operations on a bulldozer. The metal at the end is gathered and opened in the first two passes, flared in the third



THE two housing halves (Above) are joined by butt welding in an automatic flash butt welding machine, being positively located by mechanically expanding fixtures over which the two sections are mounted. Then they are hydraulically clamped on the outside, the copper faces of the clamps serving as electrodes.

THE first operation (at Right) in converting a piece of tubing into one-half of an axle housing is the expansion of a section near the end of the tube, this being the first step in forming the banjo. The heated tube is placed over a mandrel in a punch press and the bulge is formed by four fingers in the mandrel and four in the upper ram that are subjected to outward pressure when the ram moves downward. In the picture two of the fingers are shown in their extreme outward position.

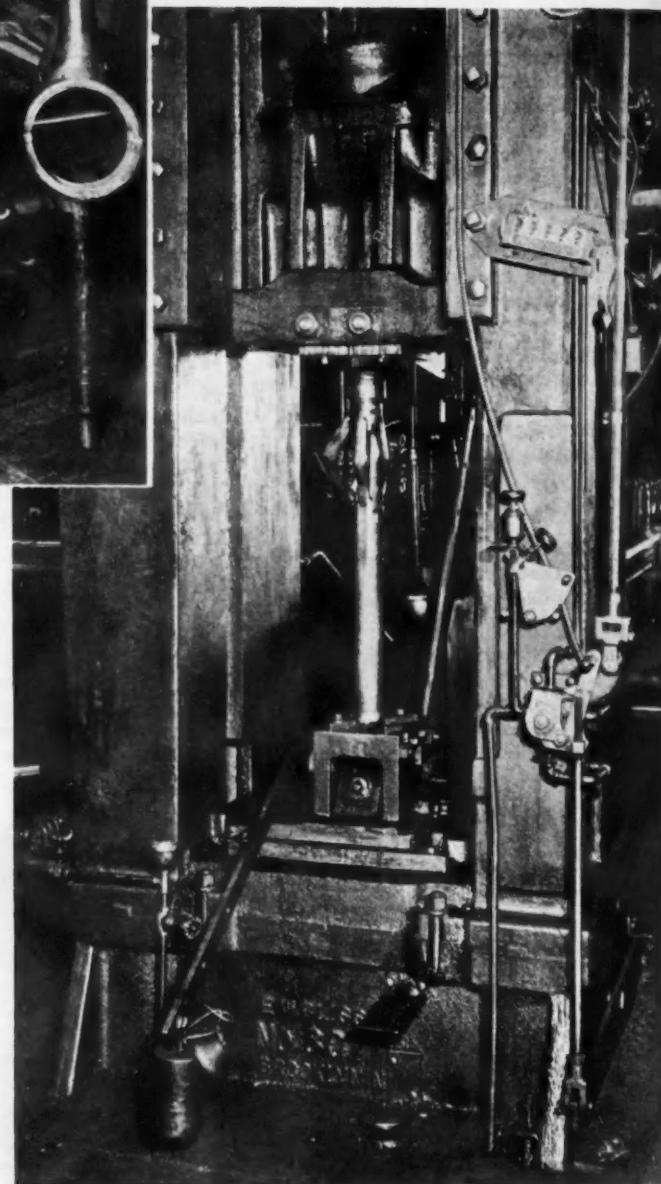
the mandrel, is swung up under the upper ram of the press. In the top of the anvil and in the upper ram of the press are four fingers which mesh on the downward movement of the ram, the fingers of each set being forced outward by contacts with cams on the opposite member or expansion head.

With this tube-expanding mechanism a portion of the heated end is subjected to concurrent axial compression and radially outward expansion, causing the formation of a bulge near the end of the tube where the size of the tube is expanded by the pressure exerted by the fingers to any diameter required to form the banjo. A 3 1/2-in. tube is expanded to the desired diameter, depending on the housing that is being produced.

While the tube is being expanded the wall of the expanded section is held to its original thickness, or, if desired, the wall in this portion may

end of the tube rather than at the middle in order that compensation for wall thickness may be accurately obtained. The expansion of the tube at one point while maintaining the wall thickness necessarily results in a slight shortening of the tube.

After the expansion of one end of the tube the opposite end is subjected



and a flange is formed in the final pass.

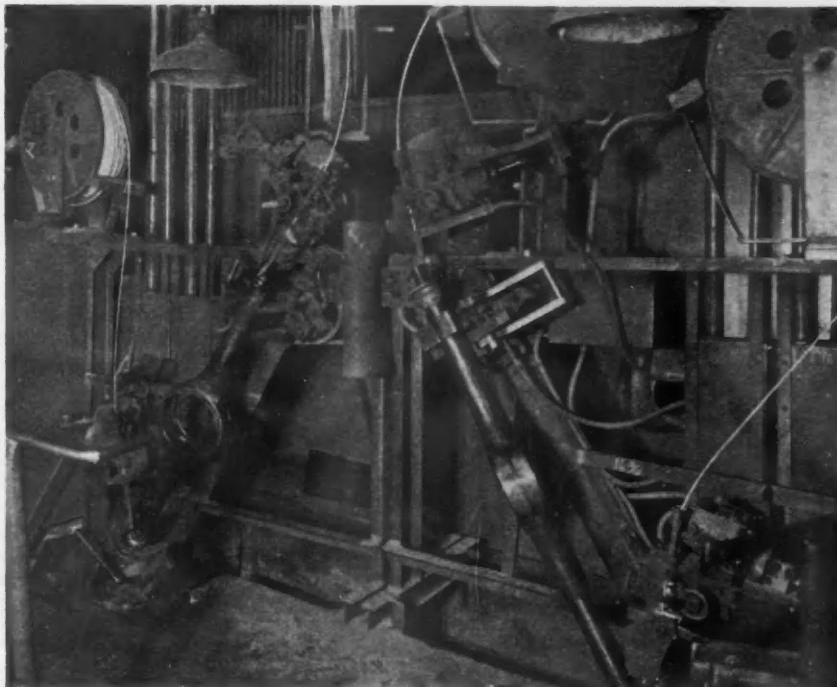
Forming Banjo Part of Housing

The succeeding step in forming the banjo end of the housing after expanding is to punch two diametrically disposed pear-shaped openings in the medial portion of the ex-

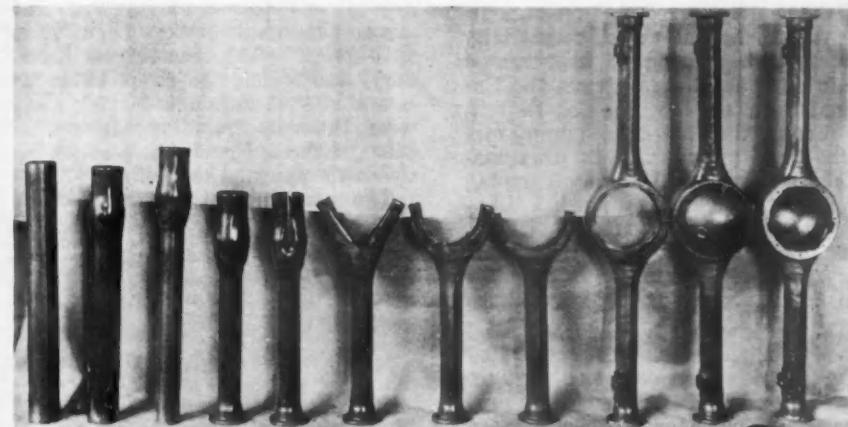
expanded section and punching slits extending from these holes to the end of the tube, thus changing the form of the end into a pair of separated arms. The enlarged end of the tube, now in a bifurcated form, is then subjected to a series of operations to transform it into its final semi-circular shape to form one-half of an axle housing. This expanded end of the tube, after being heated, is put in straightening dies which at the same time flatten the end so as to form the two arms of the end into members that are practically channel-shaped in cross-section, the arms at the same time being slightly spread out to receive forming dies.

The tube is then set upright on its flanged end on a feed mechanism that conveys it with its expanded and slotted head uppermost into two sets of forming dies. The first set of dies enters the expanded slotted ends and opens up the forks into a Y shape and the second set of dies further bends the diverging arms to arcuate shape.

The pieces are then sandblasted or pickled, after which the banjo arms and banjo circle are trimmed so that two housing halves can be placed in longitudinal alinement.



EFFICIENT set-up for welding the brake apron and bearing retainer. The housing is placed in a rotating fixture and as it revolves the part is arc welded to the housing by circumferential welds, welding being done at each end of the housing simultaneously. Duplicate welding units set side by side are attended by one operator.



THIS shows the successive major operations in forming a welded steel tube into an axle housing and the completed housing made by welding together the two halves. The housing at the extreme right is made for bolting the cup-shaped cover to the housing and adjoining it is a housing that has its cover welded on.

Assembling, which follows, is done in a number of interesting welding operations. The two halves of the housing are joined at the center of the banjo by butt welding in an automatic flash butt welder having two mechanically expanding fixtures over which the housing halves are slipped, and by the expansion of which on the inside of the tubes the two halves are positively located. Then the two housing sections are hydraulically clamped on the outside by four clamps, the copper faces of which also serve as electrodes. The flash is trimmed off the seam after welding by placing the housing in a fixture on a press which has two shearing heads set at an angle, one of which trims the inside of the banjo while the head is rotating in one direction and the other trims the outside while the rotation is in the opposite direction.

Reinforcing rings are then projection-welded to the inner surface of the housing cover flange. In these

semi-circular pieces six projections are stamped for welding. A large capacity or a 1000-kva. resistance welder of the pressure type is used for this operation. The six welds are made simultaneously while a pressure of 30,000 lb. is applied to the slide.

Spring saddles, which are attached at the end of the housing, also are projection-welded with a pressure-type machine, this being done with an 800-kva. welder in which a pressure of 27,000 lb. is applied.

A new application of welding in the manufacture of axle housings is the arc welding of the cup-shaped housing cover to the banjo. The weld to the cover flange is made along a circumferential line, the flange on the cover serving as filler material. In this case a stamped cover of 18-gage steel is welded to 11-gage material. A flux is first applied along the edges to serve as a deoxidizer. The cover

(Concluded on Advertising Page 20)



This shows the major operations in forming each half of an axle housing from a flat blank.

Develops Twin-Six Mult-Au-Matic for Smaller Classes of Work

THE Bullard Co., Bridgeport, Conn., has brought out a Twin-Six Multi-Au-Matic designed for the smaller classes of work. The machine has a total of 12 spindles, two at each of the six stations. At every index, two spindles are presented at each column face and duplicate tooling performs identical operations on the work in each of the twin chucks. The machine may be obtained with a double index, where the number of operations required in any one chucking will permit completion of machining at four stations.

In capacity, this machine, designated as the type F, is in the 7-in. class where boring, turning, facing, drilling and reaming are required. As this size of work runs to the higher speeds, high as well as low speed ranges can be furnished. The high-speed range, variable through change gears, is from 112 to 1008 r.p.m., with feeds from 0.0031 to 0.0281 in., and the low speed range is from 46 to 417 r.p.m., with feed changes from 0.0075 to 0.0678 in.

An automatic chucking mechanism has been incorporated for special chucks or fixtures as the work may require. All spindles are carried on pre-loaded roller bearings and are lubricated automatically with clean oil. In addition ball bearings are used extensively in other parts of the machine to assure smooth flow of power to the

point of cutting. All units are of heavy construction and both alloy steels and alloy castings properly heat treated are employed.

A variety of standard tool-heads—plain vertical, plain compound and universal—are offered. The plain vertical tool-head, of one-piece construction, is of sufficient width to accommodate duplex tooling and has vertical movement of 6 in. The plain compound tool-head is a single tool-slide mounted on a saddle. The total stroke of this head is 6 in., which may be applied as vertical movement only or to include maximum of 3 in. movement of tool-slide in either left or right horizontal direction. The uni-

versal tool-head comprises a single tool-slide mounted on a swivel and saddle, and functions vertically, horizontally or in an angular direction. The total stroke of 6 in. may be applied as vertical movement only, or to include a maximum of 3 in. horizontal or angular movement. Like the other slides this will also accommodate duplex tooling.

Duplex live-spindle drill heads may be applied at any working station. These heads having individual variable speeds obtained through change gears. Multiple spindle drill heads can also be supplied.

This type F Twin Six Multi-Au-Matic has a base machine weight of 18,000 lb., and a projected floor space of 63 in. in diameter, plus space of 20 x 43 in. for the chip pan. The height from the floor to the motor base is 124 in. Motors up to 35 hp., depending on work requirements, are employed.

Lapping Machine Corrects Inaccuracies of Spur and Helical Gears

FOR rapidly correcting involute curvature, helical angle, eccentricity and tooth spacing of heat-treated plain spur and helical gears, the National Broach & Machine Co., Detroit, is offering the Red Ring lapping machine here pictured. With this machine the economical limits of lapping are said to have been extended. Lapping time ranges from 2 to 5 min., floor to floor, and as the entire operating cycle is automatic, one operator can handle from four to six machines.

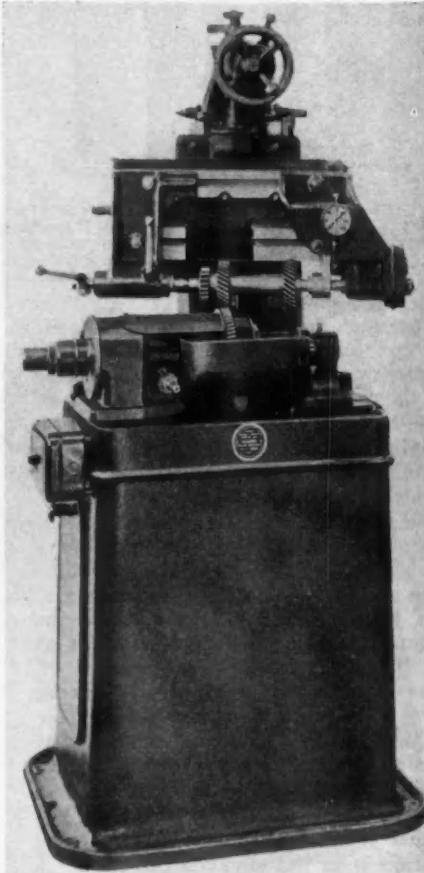
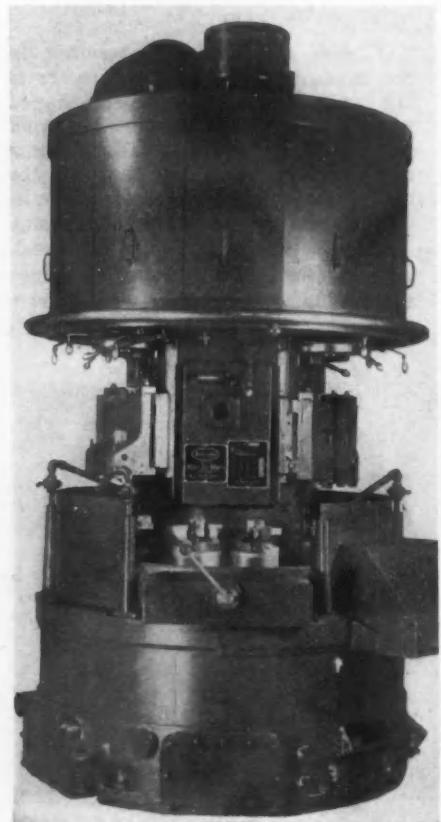
The machine operates on the crossed axes principle employed in the Red Ring gear finisher described in THE IRON AGE of Jan. 19. A specially processed lap made of electric furnace iron and finished to a tolerance of 0.0002 in. is run at high speed with the gear being lapped. The lap drives the work gear, which has no other power connection. A cutting compound is fed into the rotating units.

The axis of the work gear arbor is set at an angle with that of the lap gear shaft, this angle varying from 5 to 15 deg. In addition to the crossing of the axes, the work gear is constantly reciprocated across the face of the lap gear. This produces a continuous sliding of the lap tooth surface over the gear tooth surface in two directions simultaneously. It is stated that because of the crossed axes principle it is practicable to end-lap a gear having a shoulder at one end larger than the outside diameter of the gear itself.

Two types of lapping action, cramp and power tailstock, are obtainable. In the cramp operation, each lap tooth contacts two teeth on the work gear simultaneously; in the power tailstock action, each lap tooth contacts only one tooth of the work gear in

any given direction of rotation. The lap employed will process from 500 to 1000 gears before recutting is necessary, and it may be recut twice. It is stated that although the lap teeth wear, the shape remains constant because of the self-generating action between the lap and the gear.

The arrangement of the machine



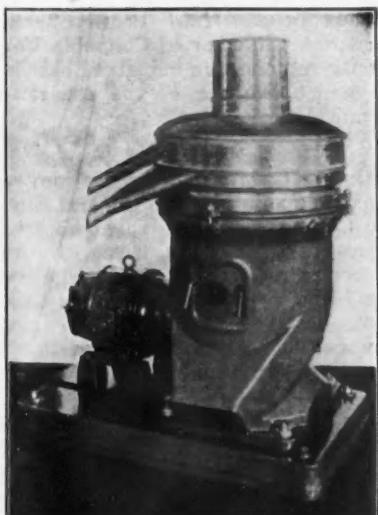
may be seen from the illustration. The base houses the drive, timing and switching mechanism. The table mounts the fixed lap shaft and the adjustable column carries a reciprocating head, which also carries the power brake for loading the work gear arbor. The head has both hand and automatic feed for adjusting the initial center-to-center distance between the gear and the lap and for feeding the gear against the lap during "cramp" operation. The power unit is a $\frac{1}{4}$ -hp. flange-type motor, and the drive is through a gear box to two shafts, one horizontal and one vertical. The horizontal shaft is belt-connected to the lap shaft on the machine table. The vertical shaft drives an eccentric which operates through the column to reciprocate the work slide that carries the gear arbor.

The column has an angular adjustment; it is equipped with a vernier scale and may be set to 6 min. of arc. By adjusting the column setting, the bearing on the gear can be shifted from one end of the tooth to the other. A hand wheel and ratchet at the top of the head controls the vertical adjustment of the work slide and also its feed.

At the right-hand end of the work arbor is the hydraulic loading brake and just above it the dial which registers the amount of load. The automatic timing controls, located in the base of the machine, consist of two levers which govern the action of the automatic switches. By means of these lever settings the lap is rotated a given number of revolutions in one direction, reversed for a given number of revolutions and stopped automatically.

Centrifugal Discharges Solids While Running

THE Rotojector centrifugal recently introduced by the Sharples Specialty Co., Twenty-third and Westmoreland Streets, Philadelphia, combines high centrifugal force with



ability to discharge its solids or bowl cake while running at full speed. This eliminates the labor heretofore required for bowl cleaning, and permits use of the Rotojector where excessive bowl cleaning would make the company's Super Centrifuge economically impractical. The new centrifugal differs from the Super Centrifuge in that there is an operating or working chamber in the bottom of the bowl assembly; the bowl can be opened by hydraulic pressure whenever desired and the entire contents expelled within 10 sec. without stopping or slowing down the machine.

The Rotojector is particularly adapted for the clarification of liquids containing up to 10 per cent of amorphous and slurry precipitates; separation of liquids containing large amounts of solids (up to 10 per cent); reclaiming of valuable liquids held in slurries; and removal and recovery of valuable sludges without the labor of bowl cleaning.

"Electronic" Cell Operates Without Batteries

THE self-generating photo-electric cell illustrated transforms light energy directly into electrical energy without the aid of batteries or other



sources of e.m.f. Tested on a direct-current milliammeter, this cell generated from 5 to 7 milliamperes in direct sunlight. The self-generated current is always proportional to the light intensity. Exposure to strong light or any climatic condition is said to have no effect on the efficiency of the cell. The device generates electrical energy at no expense to the materials used in its construction, and made of metal, except for the plain lens over the face, the device should, it is stated, last indefinitely.

Made by J. Thomas Rhamstine, 525 East Woodbridge, Detroit, this "Electronic" cell is used in the photographic field, in the Rhamstine photoelectric exposure meter. In addition to numerous other applications, the device can be employed in combination with a sensitive relay and an auxiliary relay for turning power circuits on or off. It is also suitable for experimental purposes. Compactness is a feature, the cell being $2\frac{1}{2}$ in. in diameter and 1 in. thick.

Motorized Worm Gear Speed Reducer

THE Boston Gear Works, Inc., North Quincy, Mass., has brought out a motorized worm gear speed reducer, designed to meet the demand for a simple, rugged and compact unit that will give long and efficient service. The unit consists of a special speed reducer and a standardized motor—"unitized."

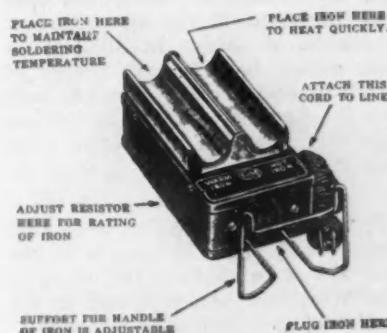


The worm and the motor shaft are made integral to assure positive alignment and quiet operation. All models are equipped with General Electric motors. Motors of other manufacture may also be used economically when complete assembly is produced in quantities. These Boston motorized speed reducers are available in various sizes, horsepowers and speeds.

Soldering Iron Stand Prevents Overheating

SAVINGS in power consumption, as well as elimination of difficulties arising from overheating, are claimed for the new soldering iron stand brought out by the G-M Laboratories, Inc., 1735 Belmont Avenue, Chicago. It is stated that with this stand the tip of the iron will remain well tinned for weeks.

The stand has two cradles. When placed in the left-hand cradle the iron receives only sufficient voltage to keep it at the minimum, but proper soldering temperature for immediate use. When the iron is placed in the right-hand cradle, full line voltage is automatically applied.



... PERSONALS ...

F. J. KING, chief engineer, Linde Air Products Co., New York, was elected president of the Compressed Gas Manufacturers Association at the annual meeting in New York last week. Mr. King has been closely identified for several years with the manufacture and application of oxygen and acetylene, particularly in connection with the welding and cutting. He became affiliated with the Linde company shortly after his graduation from the Massachusetts Institute of Technology in 1909.

◆ ◆ ◆

E. BERNDT, for many years technical director and member of the board of directors of Schiess-Defries, Inc., Düsseldorf, Germany, has received the honorary degree of Doctor of Engineering from the Technical University of Aachen.

◆ ◆ ◆

L. WALTER MOON, president, Bradley Heating Co., St. Louis, Mo., has been elected a member of the Council of the American Society of Heating and Ventilating Engineers.

◆ ◆ ◆

HOWARD A. HOLMES, heretofore assistant district sales manager in Chicago for the Weirton Steel Co., has joined the sales staff of the Detroit office of the Inland Steel Co., Chicago.

◆ ◆ ◆

WILLIAM J. MEINEL, formerly vice-president in charge of operations of the E. G. Budd Mfg. Co., Philadelphia, has been elected president of the Heintz Mfg. Co., Philadelphia, succeeding FRANKLIN W. THACHER, who has become chairman of the board. Mr. Meinel became identified with the Heintz company in June, 1932, as vice-president and general manager.

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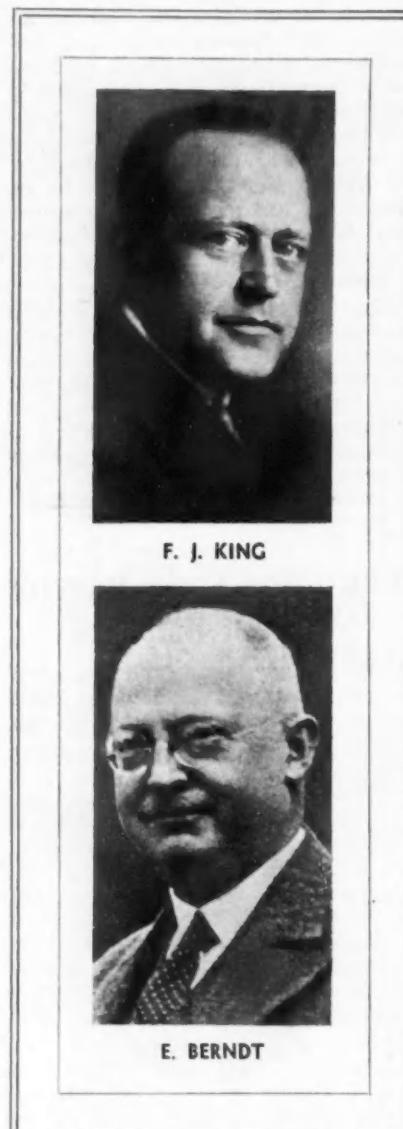
E. A. LIVINGSTONE has been appointed a sales representative of the Babcock & Wilcox Co. and the Babcock & Wilcox Tube Co., with headquarters at 85 Liberty Street, New York. He was formerly sales manager successively of the Los Angeles, Tulsa and New York offices of the A. O. Smith Corp.

◆ ◆ ◆

C. B. TEMPLETON, heretofore assistant to the president of the Ludlum Steel Co., Watervliet, N. Y., has been made assistant to the vice-president in charge of sales. In addition to other duties, he will have charge of all advertising activity. He has been with the Ludlum company in various capacities since his graduation from Yale in 1920.

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T. G. SHEDORE, who has been connected for the past 16 years with the Four Wheel Drive Auto Co., Clintonville, Wis., has been promoted to the position of assistant sales manager.



F. J. KING

E. BERNDT

HARRY A. SCHULTZ has been appointed manager of the Bureau of Safety, Sanitation and Welfare of the United States Steel Corp., succeeding the late Charles L. Close. JOHN H. OSMERS has been appointed assistant manager of the bureau, succeeding Mr. Schultz.

◆ ◆ ◆

FRED C. BARR, production manager, Harley-Davidson Motor Co., Milwaukee, has sailed for Japan to make a study of possibilities for manufacturing motorcycles in Japan, an extensive customer of the Milwaukee concern. A definite plan awaits his report.

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DARWIN S. LUNTZ, Luntz Iron & Steel Co., Canton, Ohio, was reelected president of the Cleveland-Detroit chapter of the Institute of Scrap Iron and Steel, Inc., at the annual meeting at the Hotel Hollenden, Cleveland, Jan. 24.

◆ ◆ ◆

J. E. MONTGOMERY has been named vice-president in charge of operations of the Otis Steel Co., Cleveland, succeeding R. H. CLARK, who requested an indefinite leave of absence for the purpose of relaxation and an opportunity for travel. Mr. Montgomery, who has been with the Otis company several months as assistant to the president, was formerly assistant to the president and vice-president in charge of operations of the Wheeling Steel Corp., and has had 30 years' experience in the steel industry.

◆ ◆ ◆

K. W. ATWATER, for the past five years associated with H. A. Brassert & Co., consulting engineers, Chicago, has established new headquarters in the Investment Building, Pittsburgh, where he will represent certain lines offered by the Brassert company.

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DR. GEORGE OLIVER CURME, JR., vice-president, chief chemist and director of research of the Carbide & Carbon Chemicals Corp., New York, has been awarded the Chandler Medal for 1933, for his achievements in aliphatic chemistry. The Chandler Medal and Lectureship were instituted in 1910 by friends of the late Prof. Charles Frederick Chandler of Columbia University, a pioneer in industrial chemistry and a founder of the American Chemical Society.

◆ ◆ ◆

FRANK H. GALE, manager of conventions and exhibits of the General Electric Co., has been retired at his own request after 43 years of service with the company. L. W. SHUGG, who has been identified with the company since 1902, has been appointed division manager of the publicity department to succeed Mr. Gale.

◆ ◆ ◆

LEWIS W. HICKS, JR., has been elected assistant secretary and assistant treasurer of the Allegheny Steel Co., Brackenridge, Pa.

Events Turn United States Toward a More Strongly Defensive Trade Policy

By DR. LIONEL D. EDIE

A DISTINGUISHED American authority, lecturing in England in 1929, ascribed the commercial leadership of the United States to the fact that that country with its 122 millions population contained in its own domestic market, free from all trade barriers, the greatest outlet for industrial goods which the world has ever seen. Since 1929, this domestic market has contracted violently and there appears now to be a rising school of thought which proposes to seek our escape from depression by rebuilding the domestic market.

This presents an issue which one of the American delegates to the preparatory commission of the International Economic Conference is reported to have defined as follows: "The world economically stands at a fork in the road. One fork leads to a system of self-contained national economy with a minimum of international trade. Down the other fork lies a system of international exchange of a general character which until recent years marked the pathway of economic progress. If the International Conference succeeds, it means a restoration of the system of international exchange. If it fails, the movement will, presumably, be in the other direction."

The New Nationalism

The new nationalism, which seems to be a rising tide in America, already recognizes this fork in the road. During the waiting period, while politicians and statesmen are making up their minds which course to take, the new nationalists would like to make sure that American trade safeguards itself from the upsetting influences now pouring in upon our economy from pretty much every foreign quarter of the world. Their attitude is tantamount to saying, "We don't know where the international drift is taking us. We do not assume a hostile or unfriendly attitude toward other trade areas. We have no way of knowing how long the present confusion and uncertainty will continue to exist. We have no right to sit still and do nothing in the meantime. We should look to our domestic market, build it up so that it can stand on its own feet, restore it to its former strength as a great self-contained outlet for industrial products, make it draw strength from within rather than continuing to trust in a revived internationalism as a means of salvation."

That the world has suffered from

an outburst of intense nationalism in recent years is beyond dispute. Other countries blame America, charging that it was the Hawley-Smoot tariff in 1930 that set off this nationalistic movement. The writer does not defend the Hawley-Smoot tariff, but, on the other hand, he sees no reason to hold that tariff act responsible for all the trade barriers which have grown up in the world during the past five years. The depression began long before the Hawley-Smoot tariff was enacted, and the rise of trade nationalism had become conspicuous in many countries. Since 1930 the tendency almost everywhere to increase trade barriers has been a natural consequence of the world-wide deflation of commodity prices. It is, therefore, an over-simplification of the world tendency to assume that the growth of trade barriers is due to the protective tariff of the United States.

Many Forms of Trade Barriers

The forms of trade barriers are extremely diverse. The mere increase of import tariffs has become a relatively minor form of obstruction. In many countries import quotas constitute a much more rigid denial of trade increase. Moreover, exchange restrictions and depreciated currencies subject to sharp fluctuations have taken a rank of first importance in discouraging commerce. The effect of unstable currencies cannot be measured in terms of the volume of imports or exports because the influence is often felt mainly in the form of price cuts forced upon countries still retaining a stable currency. Their domestic industry may be badly shocked by these forced price movements even though they do not actually import larger quantities of the given commodities than formerly.

The adoption of a preferential principle at Ottawa introduces a new development of trade discrimination whose ultimate consequences can not yet be measured. Among other things the preferential principle raises a threat to the most-favored-nation clause in commercial treaties.

Another form of trade obstruction is the boycott. This has been most apparent in such countries as China and India but of late it has crept into the practices of the Western countries. The "Buy British" campaign and,

more recently, the "Buy American" campaign illustrate variants of the boycott principle.

The Development of American Policy

Just how much the expected International Economic Conference can accomplish in the way of reversing these commercial trends is open to doubt. The conference may make a preliminary dent in the problem but it is scarcely to be hoped that any single conference can create a right-about face in the economic policies of thirty or forty countries. The American attitude must, therefore, look upon the whole problem as being in a state of unsettlement and an unsettlement which is likely to continue for some time to come. The American attitude might well be to strive for a broader principle of internationalism, but of not waiting for its complete fulfillment before putting our own domestic market on a more independent footing. In other words, there is perhaps room for a kind of nationalism which is not hostile or unfriendly toward group action among countries but which is strongly defensive of American interests during the interim.

Moreover, the American attitude does not have to take the form of trying to shut out all foreign goods or of trying to lock in all domestic goods. On the other hand, American policy might conceivably seek to stabilize the terms of competing so that American industries would be protected against international shocks which serve no constructive purpose.

The extreme internationalists will doubtless condemn any such American policy as being completely out of harmony with a world economic order. However, this extreme attitude may be open to just as much objection as one might well entertain toward the extreme nationalists. There is perhaps a rational middle-ground position which will serve better to meet the needs of the transitional period in which we now find ourselves.

Four regular sessions and six round table discussions have been arranged for the annual personnel conference to be held at the Palmer House, Chicago, Feb. 7 and 8, by the personnel division of the American Management Association in cooperation with the Industrial Relations Association of Chicago and the Society of Industrial Engineers.

OBITUARY

WILLIAM R. WEBSTER, consulting engineer, Philadelphia, died on Jan. 16, aged 78 years. He was graduated from Massachusetts Institute of Technology in 1875. As a consultant and director of inspection, he served railroads in England and Egypt and for a long period was in charge of the inspection for Japanese railroads of their railroad materials purchased in this country. In 1897 he was awarded the Scott Medal by the Franklin Institute for his work in the preparation of tables from which the properties of steel could be predicted from known chemical composition. Mr. Webster was one of the seven men who applied for the charter incorporating the American Society for Testing Materials in 1902 and took an active part in the association's affairs throughout his life.



V. C. TURNER, vice-president and treasurer of the Scullin Steel Co., St. Louis, died of heart disease in that city on Jan. 29, aged 62 years. He was educated at Williams College, and became connected with the Scullin Steel Co. in 1899.



T. G. SEIXAS, formerly general sales manager and in recent years assistant to the president of the Allegheny Steel Co., Brackenridge, Pa., died suddenly at his home in Philadelphia on Jan. 26, aged 59 years. He had been identified with the company for 20 years and was at one time in charge of the Philadelphia office of the company.



ADOLF A. LEDERHOS, founder, general manager and treasurer of the E. T. Ryan Iron Works, Inc., died at his home in Kendall Green, Mass., Jan. 27. He was born on Nov. 25, 1882, in Germany, and came to this country in 1910.



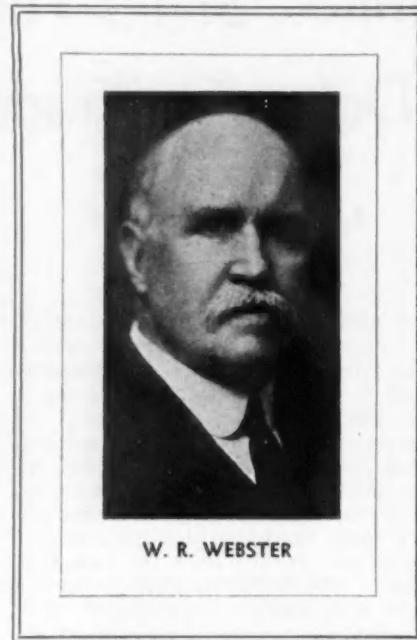
JAMES G. KELLY, president of the Kelly Foundry Co., Pittsburgh, died at his home in that city on January 27, aged 64 years. He had been identified with the foundry industry in the Pittsburgh district for more than 50 years.



GORDON C. KING, identified with the sales organization of the Jones & Laughlin Steel Corp., and a son of Willis L. King, vice-president of that company, was killed in an automobile accident near Tucson, Ariz., on January 28. He had been identified with the Jones & Laughlin company for several years, and at the time of his death was on a leave of absence because of illness.



AAGE WINCKLER, president, Winckler Engineering Co., Milwaukee, died in his sleep on Jan. 25. He was born in Copenhagen in 1882 and studied engineering at the University of Karlsruhe, Germany, and at Zurich, Swit-



superiority over common grades of high-speed steels, was developed in researches conducted by Mr. Sykes and by C. P. Miller of Romley, England. It has an iron base of approximately 50 per cent iron with a very small carbon content or less than 0.10 per cent. The outstanding features, claimed for this steel as compared with ordinary high-speed steel, are that the red hardness is more permanent, the steel not softening under the high temperature produced when a tool is used at high cutting speed and that it possesses machinability which permits it to be forged into various shapes. With the addition of cobalt, it is stated, grain refinement is made possible by quenching or air cooling, increasing the toughness and slightly increasing the hardness and eliminating the brittleness found in coarse grained steel. In addition by aging, a precipitation hardening is produced which is said to further increase the hardening that results from grain refinement.

There has been a demand, Dr. Jeffries said, for a cutting material which would fill the gap between high-speed steel and the cemented carbides. He said he believed this new steel would do this. While high-speed steel will cut at the rate of 150 surface ft. per min., Alloy 548 can cut metal at a speed of 350 ft. per min. While, as he pointed out, cemented carbide tools can run at much higher speed, this new alloy is hard to work into tools as it cannot be forged into shape. It will cost about \$4 a lb. as compared with 75c. for ordinary high-speed steel. Dr. Jeffries said that, while it is difficult to estimate how greatly the new alloy will decrease the cost of machine production, he believed that the actual time for machining would be cut one-half as compared with the use of high-speed steel and that, after taking into consideration other factors, the new alloy should cut the time of operation 25 per cent. He also pointed out the new alloy would save time taken for grinding and reshaping cutting tools and that the length of time between grinds would be increased from 2 to 20 times. The alloy will be manufactured by the General Electric Co. and marketed by the Carboly Co.

erland, specializing in automotive practice. He designed and introduced the first taxicabs in Copenhagen. In 1909 he came to America to become chief engineer, J. I. Case Motor Co., Racine, Wis., a subsidiary of the J. I. Case Threshing Machine Co., which was just engaging in the manufacture of passenger automobiles. In 1916 Mr. Winckler moved to Milwaukee and devoted himself chiefly to research and invention.



TOBIAS BOROCOFF, president and founder of the Southern Iron & Wire Works, Atlanta, died Jan. 23, aged 58 years.



KARL F. SNOW, one of the founders and a director of the C. O. Bartlett & Snow Co., Cleveland, died Jan. 29, aged 70 years. He had been actively connected with this company since its organization 46 years ago.

New High-Speed Cutting Material Announced

The development of a new high-speed cutting steel or alloy with a composition of iron, cobalt and tungsten in which cobalt is substituted for some of the iron, found in the simple iron-tungsten alloys, was announced at a meeting of the Cleveland chapter of the American Society for Steel Treating, Jan. 16, by Dr. Zay Jeffries, president, Carboly Co., Inc., and consulting metallurgist, Aluminum Co. of America, General Electric Co., and National Tube Co., and by W. P. Sykes, metallurgist, Cleveland Wire Works, General Electric Co.

The new steel, designated as Alloy 548, and claimed to have marked

Structural Fabricators Reduce Wage Rates

The American Bridge Co. and the McClintic-Marshall Corp. have reduced wages from 20 to 25 per cent in their structural steel fabricating shops.

E. G. Grace, president, Bethlehem Steel Corp., of which McClintic-Marshall is a subsidiary, said last Thursday that the reduction in pay in fabricating shops had no relation to the rate of pay of steel mill workers. Asked whether a reduction in steel mill wages was in contemplation, he said that Bethlehem Steel has no such plan in mind.



OFF THE ASSEMBLY LINE

Resumption of Ford Operations Waits On Settlement of Briggs Strike

DETROIT, Jan. 31.

DESPITE the fact that the majority of its workers are still out on strike, the Briggs Mfg. Co. this (Tuesday) afternoon began production on Ford bodies at its Highland Park plant with a force of about 600 employees. However, Ford will not reopen its Rouge plant until it is assured of steady shipments of bodies and at the moment it does not appear likely that it will resume operations until at least next week. If Ford cannot obtain bodies within a reasonable time, it probably will begin to make its own bodies. If it made this move, it might take over the Briggs plant, which is on its Highland Park property, or transfer body dies and equipment to the Rouge Plant. The latter process probably would take 30 days. Workers of the Murray Corp. also are on strike, alleging unfair working conditions. The plant of the Hudson Motor Car Co. is closed this week.

The strike of employees of the Briggs Mfg. Co., which brought production of new Ford bodies to a standstill a week ago, has resulted in a disarrangement of plans not only by the Ford Motor Co., but also by Ford parts and materials suppliers. Without warning on Thursday, the Ford company notified all vendors by telephone and telegraph to hold up shipments until further notice and announced that the Rouge plant and all branch assembly plants would close that night until bodies are available. This hit steel companies hard, as releases were held in abeyance and a steel buy for which inquiries had been put out has been postponed until activities are resumed.

Last Saturday was reported to have been the day set for the initial showing of Ford's model 40, the larger V-eight; the fact that Ford has not been able to get bodies since Monday afternoon is thought to have been the main reason for postponement. Ford's display room at its Highland Park plant has been cleared of cars for several days, and this is taken as a forerunner of the early presentation of new models. Detroit is of the opinion that

Ford will announce its new line before the current week is ended. An aluminum cylinder head and alloy steel valve inserts are among the features of Model 40. While the two lines of Ford cars will be powered by V-eight engines, it is understood that the four-cylinder motor will be retained in commercial cars and trucks, which will be called Model 46.

Ford May Not Reopen Its Steel Mill

In its contemplated purchase of steel, so unexpectedly postponed, the Ford company has in mind considering whether it will be profitable to reopen its steel mill. With steel prices as low as they are today, it is not likely that the Rouge steel works will be operated; in fact, at the moment there is little likelihood that it will be active this year. Persistent stories circulated in Detroit to the effect that several major steel companies are negotiating for the purchase of the Ford steel mill are discredited in well-informed circles. Observers point out that the mill is almost inextricably tied into the Ford set-up at Rouge, thus making it undesirable for an outside interest to run. Moreover, the steel industry has far more capacity now than it knows what to do with.

There has been a brisk retail demand for both Pontiac and Oldsmobile cars, with the result that assemblies in February will be somewhat higher than anticipated. The public's reaction to 1933 cars during the first month in which they have been shown has revealed that General Motors possesses the strongest line-up in years. Chevrolet, Pontiac and Oldsmobile are doing exceedingly well; if Buick suffers, it will be because of the general lack of buying in the \$1,000-\$2,000 class. Cadillac is doing as well as can be expected in view of the times.

Retail Sales Fairly Satisfactory

It is conservatively estimated that February production of the Chrysler divisions will be 15,000 cars, compared with about 20,000 in January and 25,-

000 in December. Plymouth output has dropped off considerably since its dealers got well stocked and since its car, introduced in November, has had the competition of other makes shown at a later date. Reports from various automobile shows indicate that attendance in most cases compares favorably with last year and sales have been at a relatively satisfactory rate. In Detroit retail sales in the first 26 days of January totaled 1984 cars, against 2249 for the entire month in 1932.

In the first month of production of its new cars Chevrolet made retail deliveries of 33,875 units. Its January output was 62,000 cars, or the highest monthly total since July, 1931. Assemblies for the entire industry during January are estimated at 120,000 units, with a strong possibility that they exceeded the 123,075 units manufactured in January, 1932.

The Chevrolet division of General Motors has started production of parts for the so-called Mercury car, which will be offered as chief competition to Mr. Ford's Model 44 V-eight now in the making. It is reported that banks of parts will be accumulated and stored until near the time for the car's introduction, when assemblies will get under way. It is said that tentatively March has been set as the month for the public showing, but no doubt the date will depend on when the new small Ford is ready.

Detroit Notes

Since Briggs supplies Murray with parts for Ford bodies, the latter was compelled to close last week until the strike is ended. The Lincoln plant likewise is idle because of inability to secure bodies. Plymouth has enough bodies from Briggs to carry it through this week, but if the strike should last longer, it also will find itself without bodies for certain models . . . Chrysler Corp. is diverting to its Canadian plants 40 per cent of its total export trade for this year, insuring employment for several hundred more men at Windsor. It is estimated that 1000 cars a month will be built for export.

Corporation Preferred Dividend Cut to Rate of \$2 Annually

Operating Deficit for Fourth Quarter, at \$3,828,272, Is Smaller Than in Previous Quarter—No Action on Wages

DIRECTORS of the United States Steel Corp., on Tuesday, reduced the regular quarterly dividend of 1½ per cent on the preferred stock to ½ per cent, or 50c. a share. This is the first time the rate of 7 per cent annually on the preferred stock has been cut since the corporation was formed. No action was taken on wages, although it would not be surprising if a reduction in wage rates were announced later in view of the poor returns reported in the corporation's statement for the fourth quarter of 1932. The showing, however, was better than in the third quarter, when the operating deficit was the largest in the company's history.

The deficit for the fourth quarter resulting from operations, after deducting all expenses, including ordinary repairs and maintenance of plants and taxes, was \$3,828,272, compared with \$4,474,719 for the third quarter. Charges for depletion, depreciation and obsolescence accounted for \$9,351,961 and bond interest was \$1,319,481, making a total deficit from operations of \$14,499,714, compared with \$15,155,072 in the previous quarter. A special charge for overhead expenses of the Lake Superior iron ore properties and Great Lakes transportation service totaled \$2,331,293. Preferred dividends called for an outlay of \$1,801,405. The total quarterly deficit, provided from surplus, was \$18,530,773.

Operations for the entire year, based on production of steel products, averaged 18.3 per cent of capacity, compared with 38 per cent in 1931. Operations for the second half were 15.4 per cent of capacity, dropping in August to the all-time low figure of 13.6 per cent. There was some betterment in business during September and October, but the demand receded noticeably in November and December.

The operations for the year 1932, as well as for 1931, present the following results as shown in the accompanying table.

Including allowances for deterioration, exhaustion and retirement of fixed property, the year's reduction in net assets, working and fixed, has been \$90,186,000. The year's reduction in net working assets, including cash, United States Govern-

ment securities, receivables and inventories, has been \$70,000,000.

A large draft has accordingly been made upon the cash and working resources of the corporation; notwithstanding the introduction of drastic economies, as well as reduction of wages and salaries.

Buffalo Tank Corp. Buys Staten Island Plate Shop

The Buffalo Tank Corp., Buffalo, has purchased the tank and plate fabricating plant of the United Dry Dock Corp., Staten Island, N. Y., and takes possession as of Feb. 1. The United Dry Dock plant has an annual capacity of 15,000 tons of fabricated plate work. The Buffalo Tank Corp. states that the Staten Island plant is adequately equipped and no new machinery will be purchased. No change in the capital structure or executives of the Buffalo company will be made.

Pressed Steel Car Co. Receivership Deferred

Pressed Steel Car Co., Pittsburgh, was granted a stay by the New Jersey Court of Errors and Appeals on Jan. 23, which will defer action for receivership instituted by holders of \$7,000 of defaulted bonds. The court action restrains the receivers from taking charge until further orders, provided the company officers declare no dividends and make no disbursements except those necessary to current business.

Cleveland Citizens Plead For Newburgh Plant

A delegation of Cleveland citizens, headed by Mayor Ray T. Miller, conferred in New York last week with the executives of the United States Steel Corp. in an effort to change the decision of the corporation with respect to the scrapping of the New-

burgh steel plant of the American Steel & Wire Co. in Cleveland.

Myron C. Taylor, chairman; William A. Irvin, president, and W. J. Filbert, chairman of the finance committee, listened to the pleas of the Cleveland delegation and promised to submit the matter to the finance committee.

Several weeks ago the Steel Corporation announced that for economy reasons it would abandon the Newburgh plant. Modernization of the plant, it was said, would require a larger expenditure than would be justified under present conditions.

U. S. Automobile Output 1,370,728 Units in 1932

WASHINGTON, Jan. 31.—The production of motor vehicles in the United States in 1932 totaled 1,370,728 units, a drop of 1,019,010 under the 1931 output, according to reports received from manufacturers by the Bureau of the Census. The December, 1932, production was 107,403 against 59,567 in November.

The Canadian production last year was 60,816 units compared with 82,621 in 1931. In December of last year it was 2139 against 2204 in November.

Steel Companies Object To Car Placing Charge

WASHINGTON, Jan. 31.—The United States Steel Corp. subsidiaries have filed a brief with the Interstate Commerce Commission protesting against charges being made for the placing of cars on the tracks of industrial plants. If such charges are made, the brief contends, they should also be applied to the placement of cars on team tracks and private sidings.

The commission is conducting an inquiry to determine whether such terminal services in whole or in part are services which connecting common carriers are by law duty-bound to perform.

The Steel Corporation contends that such charges would drive a vast amount of business now enjoyed by the railroads to competing forms of transportation.

Cylinder Borers Using Carbide Tools

In the article on "Rehabilitation Savings Establish Low Plymouth Costs," in THE IRON AGE of Dec. 8, 1932, the cylinder boring machines described in the third and fourth paragraphs on page 874 are referred to as "the first . . . to be built for use with cemented tungsten carbide tools . . ." Our attention has been called to the fact that other cylinder boring machines so equipped were in use in other automotive plants at least as early as 1930.—[Editor.]

OPERATIONS FOR 1931 AND 1932

	Year 1932 Deficit	Year 1931 Income
Operating net deficit (income in 1931), exclusive of depreciation allowance	\$31,949,937	\$60,356,036
Preferred stock dividends heretofore declared (5½ per cent in 1932)	18,914,757	25,219,677
Common stock dividends	38,983,949
Total draft on cash surplus	\$50,864,694	\$1,847,590
Depreciation allowances	39,321,863	47,317,895
Total reduction surplus	\$90,186,557	\$49,165,485

• • EDITORIAL COMMENT • •

Depreciated Currencies Bar Recovery

all that is required to bring about recovery is confidence and that confidence can be restored by balancing the Federal budget. It is true that balancing the budget might preserve Federal credit for a time, but it would have no lasting effect unless there were a substantial rise in production. Taxes come out of production, and budget balancing, despite the sharpest slashes in public expenditures that can be hoped for, means an increase, rather than a decrease, in the tax burden on production.

An idle plant may be a source of taxes for a time but will not yield revenue for long unless production is resumed. An industrial country producing on an abnormally small scale and accumulating deficits, rather than profits, cannot continue to sustain Federal credit, no matter how heroic an effort may be made to balance the budget.

It is true that so long as Federal credit is secure there will be a continuing market for Government securities. These in turn bolster up the reserves of our banking system and make more private lending and investment possible. But to make the flow of credit to industry possible is not equivalent to setting such a flow in motion. All that is necessary, we are told, is confidence. But what creates confidence? Confidence arises only when there is faith that industry will produce profits and not losses.

How far the steel industry is from a profitable condition is given new emphasis by the quarterly statements of the United States Steel Corp. and the Bethlehem Steel Corp. These reports demonstrate that our most fundamental industry cannot live on a 15 per cent operation. And what is true of steel is also true of most of the metal-working industry. To be sure capital structures, salaries, wage rates and living standards could all be depressed to levels which would yield earnings at a 15 per cent operation or even a 5 per cent operation, but such action would mean wholesale bankruptcy. It would mean a sweeping confiscation of capital, widely held by institutions, corporations and individuals, which would be nothing short of calamitous.

We are not dealing with a question of inefficiency. The increase in economy and efficiency by the steel industry and the steel using industries has been the one bright spot in the depression. Steel makers could earn profits today with an output of 35 to 40 per cent, depending on the products made. But the steel industry, like many other industries, has been unable to make operating savings fast enough to keep pace with the deflation of values.

And what accounts for the sharp descent of values? The underlying cause of the chronic weakness in prices, in the opinion of the steel trade, is the collapse of international values resulting from currency depreciation in a large part of the outside world. Currency depreciation has been a double-edged sword. It has, in effect, raised trade barriers against us and lowered our own tariff to import trade. American steel is now virtually shut out of the rest of the world and is constantly being under-

mined in its domestic market by the low prices quoted on foreign steel. And the steel industry is not alone in suffering from this influence. The entire commodity price structure is exposed to the same strong downward pull of low international values.

This economic danger cannot be dismissed by saying that imports have declined. It is only natural that they should recede as the purchasing power of this country dries up.

President Hoover is said to favor a general return to the gold standard throughout the world as a solution for this problem, but it is doubtful whether this could be accomplished and, at any rate, it would take much time when time is precious. Others believe that currency inflation in this country would be the way out, but unless such a move were followed by devaluation of the dollar it would probably have little effect on the price situation. Devaluation, in turn, would increase the instability of international exchange and would tend to put a premium on currency depreciation as a world trade weapon.

Mutual stabilization of currencies and mutual lowering of tariffs would probably bring benefits to all concerned, but pending such action—if, indeed, it be ever taken—America must live. And to live, it must find a way of operating its industries at a profit. That can be accomplished only by protecting ourselves from the undermining influence of the low prices of the rest of the world.

Prosperity cannot be rebuilt on the quicksands of sinking international values. But substantial recovery can be attained by regaining a portion of the domestic business that we have lost as a result of worldwide price demoralization. Other countries have protected themselves from the competition of depreciated currency countries. In November, 1931, shortly after Great Britain went off the gold standard, France established "provisional compensating exchange surtaxes." Canada also took action by the issuance of an Order in Council. Under this order, for instance, the value of the pound sterling is set at a given figure, at present \$4.40, and the difference between that established rate and a two-week market rate fixed by the Revenue Department is used to compute a compensating "dumping" duty.

The Hill bill, now before Congress, would achieve the same end for the United States. It commands itself to the earnest support of the entire metal-working industry. It offers the only hope of providing a firm base for prices. With our industries prostrate and our buying power sharply reduced we haven't the economic strength to absorb enough imports to raise the world price level. As a leading steel producer has said, "For our self-preservation we must shut ourselves in." Once profits are again possible, even though they be small, confidence will revive, credit will expand, employment will gain and our ability to absorb foreign goods will increase. Profit is the necessary precursor of recovery. Profit is the driving force of enterprise.

James A. Farrell Urges Protection Against Depreciated Currencies

WASHINGTON, Jan. 31—Declaring that stabilized currencies are one of the great needs of the world of business today, James A. Farrell, chairman of the foreign commerce department committee of the United States Chamber of Commerce, urged immediate enactment of legislation to protect American producers and manufacturers against the destructive effects of imports from countries having depreciated currencies. He appeared before a sub-committee of the House Committee on Ways and Means last Friday. The hearings were held upon the strength of a recommendation made by President Hoover, who said that either this form of legislation or increases in the tariff were necessary to protect American industry.

The proposed legislation has found added strength in view of the growing injury being done American industry by imports from countries that have gone off the gold standard. It is generally doubted, nevertheless, that the present Congress, with its record of little or no accomplishment, will enact the legislation.

The House, however, will vote on the legislation Feb. 13. This vote has been forced by resort to a so-called discharge petition, an extreme measure, introduced by Representative Schafer, Republican, of Wisconsin, taking the legislation from the Ways and Means Committee and bringing it to the floor of the House. Previously the legislation had been tied up in committee by the Democrats. It has considerable Democratic support, though, as evidenced by the fact that many signed the discharge petition and it is the belief of a number of leading Democrats that the bill will pass the House. Its passage by the Senate before adjournment on March 4 is unlikely.

Legislation to overcome the effect of depreciated currencies also was urged by T. W. Kennedy of the Mystic Iron Works, Everett, Mass., and many others.

Large Imports From Countries Having Depreciated Currencies

Mr. Farrell laid before the subcommittee recommendations of the foreign commerce department committee of the Chamber which were made after a survey to show the effect of competition with countries that had gone off the gold standard. Among the findings of the committee, which the former president of the United States Steel Corp. said were significant was that some 52 per cent of the products at present being imported into the United States come from countries having depreciated currencies. It was also found, he said, that there had not been in the depreciated currency countries the increases in wholesale prices which "some economists tell us would

take place in a degree commensurate with the decrease in currency values."

The committee recommended that legislation to meet the situation should apply to countries having currency depreciation amounting to 5 per cent or more from their par value, this margin eliminating excessive administration work in applying the provisions of the law. It also suggested that a charge sufficient to compensate for the amount of currency depreciation should be placed upon all imports, both dutiable and free, with certain exceptions. These exceptions would be applied to products not produced in the United States in quantities of recognized commercial significance, such as rubber, etc.

The committee also recommended that there should be adequate safeguards against the shipping of depreciated currency products through third countries.

Finally, the committee, Mr. Farrell pointed out, recognized that the application of existing ad valorem duties to a depreciated currency base, as at present in effect, constituted a serious loss of revenue to the Government and therefore recommended that existing ad valorem duties should apply to the depreciated values plus the compensating depreciated currency charge.

Blast Furnaces Badly Hit

President Kennedy of the Mystic Iron Works, Everett, Mass., urged quick passage of the Hill bill which provides that when the currency of a foreign country depreciates as much as 5 per cent a tax sufficient to compensate for the depreciation shall be assessed against imports. Mr. Kennedy also spoke for the Reading Iron Co., Philadelphia; Davison Coke & Iron Co., Pittsburgh; Alan Wood Steel Co., Conshohocken, Pa.; Pulaski Iron Co., Pulaski, Va.; E. & G. Brooke Iron Co., Birdsboro, Pa.; Punxsutawney Furnace Co., Punxsutawney, Pa.; Chateaugay Ore & Iron Co., Lyon Mountain, N. Y.; Witherbee-Sherman Co., Port Henry, N. Y.; Perry Iron Co., Erie, Pa., and Adrian Furnace Co., Dubois, Pa.

Of all these companies, Mr. Kennedy told the sub-committee, only one has a blast furnace in operation, that of the Alan Wood Steel Co. Imports due to depreciated foreign currencies were held to be partially responsible for the position in which the blast furnace interests find themselves.

During the last year of the operation of Mystic furnace, idle since Aug. 31, 1931, Mr. Kennedy said the cost of production of pig iron was \$18.71 a ton. Indian iron was sold recently, he stated, at \$13.07, f.o.b. cars, Boston, or \$5.64 less than the cost of Mystic furnace. A price of \$13, f.o.b. dock, Providence, R. I., it was explained,

was made on a sale of Dutch iron. This was said to be \$7.78 under the price at which Mystic iron could be laid down at Providence, based on a cost of \$18.71 plus a freight rate of \$2.07. Dutch iron also has been sold, it was stated, at \$13 laid down at the dock, Bridgeport, Conn., representing \$8.59 against the furnace at Everett.

Holland Buys Low-Priced Ore

It was observed by Mr. Kennedy that the Netherlands is on the gold standard, but he pointed out that Holland gets raw material from countries off the gold standard. Holland, Mr. Kennedy said, uses Spanish ore and can buy it with Spanish currency, depreciated at 56 per cent; African ore, which can be bought with the \$3.30 pound sterling and fuel which can be bought with the depreciated mark. Holland, it was stated, also has the advantage of labor costs comparable with the rates of its depreciated currency neighbors. He said he would like to see enactment of legislation to take care of this situation also.

Pig iron can be delivered from Holland to Atlantic seaport points for \$1 a ton, it was declared, while it costs Mystic \$1.50 to deliver pig iron from Everett to Lynn, Mass., nearby. Mr. Kennedy said he was not complaining of the rail rate, but explained that if there is any way that this difficulty could be solved it would be a "wonderful thing."

"The country has imposed a severe restriction on immigration and yet by continuing to allow the importations of foreign material from countries with depreciated currencies we are, in effect, permitting the equivalent of unrestricted immigration and, moreover, the foreign peoples engaged in the production of the imports thus admitted are not contributing to the total consumption within the United States," said Mr. Kennedy. "In effect, then, we have not only the production result of unrestricted immigration, but we do not enjoy the purchasing power of the peoples so employed. On the other hand, we are furnishing our capital to support them in their own home consumption and in their productive employment."

Declares Tariff Is a Joke

The country has done very badly by its labor, Mr. Kennedy said, when it permits a man in Japan to take a job from a man in Massachusetts or in Pennsylvania or in New York; when it permits an East Indian laborer to take the bread out of the mouth of a coal miner in West Virginia.

Mr. Kennedy declared that at the prices that are being made on the eastern seaboard and in the section of the country where his concern sells pig iron it is not a matter of competition with home producers.

"It is a race between India and Japan and the Netherlands and England for our own pig iron business," he said. "Their prices are so far under the market that it is not possible to compete. Our (tariff) rate of \$1.125 per ton is simply a joke."

SUMMARY OF THE WEEK'S BUSINESS

Steel Output Rises to 19 Per Cent Despite Automobile Hold-Ups

**Suspension of Plants of Ford Motor Co. and Body Builders, However,
Affects Some Mill Schedules—Sheet Prices Still Weak**

DESPITE interruptions in steel mill schedules in some districts occasioned by the shutdown of the plants of the Ford Motor Co. and suppliers of its automobile bodies, steel production has forged ahead this week to fully 19 per cent of the national capacity, or two points above THE IRON AGE estimate for last week.

This rise has been brought about chiefly by a sharp upturn in the Chicago district, where production is at 18 per cent against 14 per cent a week ago, and a correspondingly good increase in the Valleys, where one plant has stepped up steel making to fill a rush order for 14,000 tons of line pipe and another plant, inactive for some time, has resumed. There has also been a moderate step-up in the Birmingham district, where the Ensley rail mill of the Steel Corporation is engaged on a short run.

Operations both in steel making and finishing departments have lost ground at Cleveland and Detroit and have no more than held their own at Pittsburgh. The Cleveland and Detroit districts are principally affected by the Ford suspension and a falling off in the volume of new business from other motor car manufacturers. The Cleveland rate has dropped from 44 to 38 per cent of capacity.

ALTHOUGH January has brought a moderate improvement to the steel industry, it was less than might have been expected, considering that seasonal tendencies usually begin to exert themselves more forcibly at this time of the year. However, the fact that steel ingot production has risen from 12 or 13 per cent in the final week of December to 19 per cent at the beginning of February with no important aid from the railroads or from building construction gives some reason for mild encouragement, notwithstanding that steel companies' financial reports point clearly to the necessity for considerable further gains before a "break-even" basis can be attained.

The performance of the automobile industry continues to attract the most attention in the steel trade, since it is the most tangible prospect for tonnage to sustain the present operations of many mills. Notwithstanding the Ford Motor Co.'s difficulties, January output of cars was fully 120,000 units, and official figures may, in fact, show that the 123,075 units produced in January, 1932, were exceeded. Chevrolet's January total was 62,000 cars, about 15,000 more than was contemplated and the best record for that company since July, 1931. Chevrolet made retail deliveries of 33,875 cars during the month. Its February schedule may be somewhat smaller, possibly not more than 50,000 cars. Other car makers may also reduce

schedules this month, but, if Ford operations are resumed soon, the output by that company may offset declines elsewhere.

Prospects for railroad buying are confined to the bare expectation that some rail inquiries will be issued within 30 days. Although Western roads have released some small rail orders against old contracts, enabling both of the Chicago district rail mills to run this week, and have also bought a fair amount of track supplies for necessary maintenance work, the aggregate of railroad orders is still disappointingly small.

Building construction is also lagging, though inquiries have come into the market for a total of 29,000 tons of fabricated structural steel, of which more than half is 17,000 tons for a bridge at Hartford, Conn. Lettings for the week were only 6500 tons.

PRICE weakness has become as serious a concern to the steel industry as lack of substantial business improvement. In fact, the continued decline in quotations on some grades of sheets is definitely delaying the ordinary post-inventory replenishment buying that might normally be expected under more stable conditions. Weakness is most pronounced in galvanized sheets, which are being freely offered by a number of mills at 2.50c. a lb., Pittsburgh, or \$7 a ton below the ruling quotation during the fourth quarter. A number of other grades are being offered at concessions of \$1 or \$2 a ton to large buyers. Cold-rolled strip steel also has weakened.

Efforts are being exerted to stabilize sheet prices, but without apparent success thus far, as some companies are taking business at whatever prices seem to be necessary to meet the situation. Some of the larger companies that have been holding aloof from the more drastic price cutting are said to be contemplating the establishment of low minimum levels that will discourage further concessions and bring back a more orderly condition in the market. Price irregularities have extended to standard pipe owing to the efforts of two or three small mills to get business, but the larger makers are adhering to regular discounts. Plates from Eastern mills have reached a more definite alignment, with a range of 1.40c. to 1.60c., Coatesville, the price quoted depending upon the attractiveness of the tonnage.

Scrap markets show a stronger tendency, although prices have not changed much. THE IRON AGE composite price for heavy melting steel remains at \$6.75 a gross ton, while pig iron and finished steel are also at last week's levels of \$13.56 a gross ton and 1.923c. a lb. respectively.

▲ ▲ ▲ A Comparison of Prices ▲ ▲ ▲

**Market Prices at Date, and One Week, One Month and One Year Previous
Advances Over Past Week in Heavy Type, Declines in Italics**

Pig Iron

Jan. 31, 1933 Jan. 24, 1933 Jan. 3, 1933 Feb. 2, 1932

Per Gross Ton:					
No. 2 fdy., Philadelphia.....	\$13.34	\$13.34	\$13.34	\$15.64	
No. 2, Valley furnace.....	14.50	14.50	14.50	15.50	
No. 2 Southern, Cin'ti.....	13.82	13.82	13.82	13.82	
No. 2, Birmingham.....	11.00	11.00	11.00	11.00	
No. 2 foundry, Chicago*.....	15.50	15.50	15.50	16.50	
Basic, del'd eastern Pa.....	13.50	13.50	13.50	16.25	
Basic, Valley furnace.....	13.50	13.50	13.50	15.00	
Valley Bessemer, del'd P'gh.....	16.89	16.89	16.89	17.89	
Malleable, Chicago*.....	15.50	15.50	15.50	16.50	
Malleable, Valley.....	14.50	14.50	14.50	16.00	
L. S. charcoal, Chicago.....	23.17	23.17	23.17	23.17	
Ferromanganese, sea'b'd car-lots	68.00	68.00	68.00	75.00	

*The average switching charge for delivery to foundries in the Chicago district is 61c. per ton.

Finished Steel

Jan. 31, 1933 Jan. 24, 1933 Jan. 3, 1933 Feb. 2, 1932

Per Lb. to Large Buyers:					
Hot-rolled annealed sheets, No. 24, Pittsburgh.....	2.00	2.00	2.10	2.15	
Hot-rolled annealed sheets, No. 24, Chicago dist. mill.....	2.10	2.10	2.20	2.30	
Sheets, galv., No. 24, P'gh.....	2.50	2.65	2.85	2.75	
Sheets, galv., No. 24, Chicago dist. mill.....	2.60	2.65	2.95	2.90	
Hot-rolled sheets, No. 10, P'gh.....	1.45	1.45	1.55	1.60	
Hot-rolled sheets, No. 10, Chicago dist. mill.....	1.55	1.55	1.65	1.70	
Wire nails, Pittsburgh.....	1.80	1.80	1.95	1.95	
Wire nails, Chicago dist. mill.....	1.85	1.85	2.00	2.00	
Plain wire, Pittsburgh.....	2.10	2.10	2.20	2.20	
Plain wire, Chicago dist. mill.....	2.15	2.15	2.25	2.25	
Barbed wire, galv., Pittsburgh.....	2.60	2.60	2.60	2.60	
Barbed wire, galv., Chicago dist. mill.....	2.65	2.65	2.65	2.65	
Tin plate, 100 lb. box, P'gh.....	\$4.25	\$4.25	\$4.25	\$4.75	

Rails, Billets, etc.

Per Gross Ton:

Rails, heavy, at mill.....		\$40.00	\$40.00	\$40.00	\$43.00
Light rails at mill.....	30.00	30.00	30.00	34.00	
Rerolling billets, Pittsburgh.....	26.00	26.00	26.00	27.00	
Sheet bars, Pittsburgh.....	26.00	26.00	26.00	26.00	
Slabs, Pittsburgh.....	26.00	26.00	26.00	27.00	
Forging billets, Pittsburgh.....	31.00	31.00	31.00	34.00	
Wire rods, Pittsburgh.....	35.00	35.00	37.00	37.00	
Cents Cents Cents Cents					
Skelp, grvd. steel, P'gh, lb....	1.60	1.60	1.60	1.50	

Finished Steel

Per Lb. to Large Buyers:

	Cents	Cents	Cents	Cents
Bars, Pittsburgh.....	1.60	1.60	1.60	1.50
Bars, Chicago.....	1.70	1.70	1.70	
Bars, Cleveland.....	1.65	1.65	1.65	1.55
Bars, New York.....	1.95	1.95	1.95	1.85
Tank plates, Pittsburgh.....	1.60	1.60	1.60	1.50
Tank plates, Chicago.....	1.70	1.70	1.70	1.70
Tank plates, New York.....	1.698	1.698	1.898	1.798
Structural shapes, Pittsburgh.....	1.60	1.60	1.60	1.50
Structural shapes, Chicago.....	1.70	1.70	1.70	1.70
Structural shapes, New York.....	1.86775	1.86775	1.86775	1.76775
Cold-finished bars, Pittsburgh.....	1.70	1.70	1.70	2.00
Hot-rolled strips, Pittsburgh.....	1.45	1.45	1.45	1.40
Cold-rolled strips, Pittsburgh.....	1.80	1.90	1.90	1.90

Old Material

Per Gross Ton:

Heavy melting steel, P'gh.....	\$8.25	\$8.25	\$8.25	\$10.25
Heavy melting steel, Phila.....	6.75	6.75	6.75	7.50
Heavy melting steel, Ch'go.....	5.25	5.25	5.25	7.25
Carwheels, Chicago.....	7.50	7.75	7.00	7.50
Carwheels, Philadelphia.....	8.00	8.00	8.00	10.50
No. 1 cast, Pittsburgh.....	9.00	9.00	9.50	10.00
No. 1 cast, Philadelphia.....	8.00	8.00	8.00	10.00
No. 1 cast Ch'go (net ton)....	6.25	6.25	6.25	7.50
No. 1 RR. wrot., Phila.....	7.50	7.50	7.50	8.50
No. 1 RR. wrot., Ch'go (net)....	4.50	4.50	4.00	6.50

Coke, Connellsville

Per Net Ton at Oven:

Furnace coke, prompt.....	\$1.75	\$1.75	\$1.75	\$2.25
Foundry coke, prompt.....	2.50	2.50	2.50	3.50

Metals

Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Lake copper, New York.....	5.00	5.00	5.00	6.87½
Electrolytic copper, refinery.....	4.75	4.75	4.75	6.50
Tin (Straits), New York.....	23.50	23.00	22.50	22.25
Zinc, East St. Louis.....	2.87½	3.00	3.12½	2.85
Zinc, New York.....	3.24½	3.37	3.49½	3.22
Lead, St. Louis.....	2.87½	2.87½	2.87½	3.55
Lead, New York.....	3.00	3.00	3.00	3.75
Antimony (Asiatic), N. Y....	5.80	5.80	5.40	7.25

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our market reports on other pages.

▲ ▲ ▲ The Iron Age Composite Prices ▲ ▲ ▲

Finished Steel

Jan. 31, 1933
One week ago
One month ago
One year ago

Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot rolled strip. These products make 85 per cent of the United States output.

	HIGH	LOW		HIGH	LOW							
1932	1.977c.	Oct. 4;	1.926c.	Feb. 2	\$14.81.	Jan. 5;	\$13.56.	Dec. 6	\$8.50.	Jan. 12;	\$6.42.	July 5
1931	2.037c.	Jan. 13;	1.945c.	Dec. 29	15.90.	Jan. 6;	14.79.	Dec. 15	11.33.	Jan. 6;	8.50.	Dec. 29
1930	2.273c.	Jan. 7;	2.018c.	Dec. 9	18.21.	Jan. 7;	15.90.	Dec. 16	15.00.	Feb. 18;	11.25.	Dec. 9
1929	2.317c.	April 2;	2.273c.	Oct. 29	18.71.	May 14;	18.21.	Dec. 17	17.58.	Jan. 29;	14.08.	Dec. 3
1928	2.286c.	Dec. 11;	2.217c.	July 17	18.59.	Nov. 27;	17.04.	July 24	16.50.	Dec. 31;	13.08.	July 2
1927	2.402c.	Jan. 4;	2.212c.	Nov. 1	19.71.	Jan. 4;	17.54.	Nov. 1	15.25.	Jan. 11;	13.08.	Nov. 22

Pig Iron

\$13.56 a Gross Ton
13.56
13.56
14.64

Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

Steel Scrap

\$6.75 a Gross Ton
6.75
6.92
8.33

Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

Pittsburgh Steel Business Has Shown No Further Improvement

Gain in January Over December Less Than Might Have Been Expected—Price Weakness Still Prevalent

PITTSBURGH, Jan. 31.—Business has shown no further improvement in the last week, and labor difficulties in the Detroit district have interrupted movement of automotive materials into that territory. Pittsburgh and Valley mills have not been materially affected, although one or two companies have been forced to reduce production schedules.

Aggregate orders for finished steel products in January exceeded those of December by only a very narrow margin when a considerable improvement might have been expected. Some companies did less business this month than in December.

Structural steel and reinforcing bar tonnage continues light, but new inquiry for fabricated material seems to be improving. Tin plate specifications are just about holding their own, but production seems to be tending downward.

Steel ingot output in the Pittsburgh district still averages 15 per cent of capacity, with no immediate prospect for improvement. In the Valleys and nearby northern Ohio, production has risen to 20 per cent, the highest rate of the year. This is partially due to a large pipe order recently placed for immediate shipment and to resumption of a large plant which has been inactive. Ingot production in the Wheeling district is holding at 35 per cent.

Steel prices continue weak, with the market on desirable tonnage in nearly all products at sharp variance from the quoted figures. Sheets and strip steel show particular weakness, with some grades of sheets quotably lower. Semi-finished steel is holding. Efforts are being made to establish minimum quotations on the heavy hot-rolled products.

Pig Iron

While shipments to local foundries during January were somewhat heavier than in the preceding month, demand has failed to show any significant upward trend. Many foundries which closed down late in the year have not yet resumed production, although some of the radiator and sanitary ware makers in the district are slightly busier. No sales have been reported to establish price levels on merchant iron, and quotations continue largely nominal.

Semi-Finished Steel

Non-integrated makers of sheets are seeking lower quotations on semi-finished steel to compensate for the sharp decline in sheet steel prices.

However, sellers continue to quote \$26, Pittsburgh or Youngstown, on sheet bars as well as billets and slabs, although no recent sales have been reported. Forging billets are well maintained at \$31, Pittsburgh, and wire rods are now being generally quoted at \$35, Pittsburgh or Cleveland.

Rails and Track Accessories

No new business has been placed in the last week, and specifications continue at a minimum. Resumption of production by the local rail mill seems to have been indefinitely postponed.

Bars, Plates and Shapes

The market continues quiet and orders this month are falling behind those of December with some makers. A few large structural steel and reinforcing bar projects are still before the trade, but new inquiries are light. The plate market is also stagnant, with barge builders promising the best outlet in the immediate future. Several companies are considering the purchase of a number of barges, and Government jobs are closing every week in various parts of the country. Tank fabricators are getting little work from the oil industry, which is watching its purchases more closely than ever since recent declines in crude oil were announced. Merchant bars are dull, although shipments to the automobile industry are fairly well maintained.

Bar, plate and shape prices are fairly well maintained at 1.60c., Pittsburgh, on small lots, and efforts are being made to establish a minimum figure on large tonnages. Attractive business has brought out sharp concessions for many months, but some of these prices, particularly on structural shapes, are said to have been withdrawn recently. The reinforcing bar market is holding fairly well at 1.50c., Pittsburgh, in this district, with shading confined principally to the New York and Philadelphia territories.

Cold-Finished Steel Bars

The market continues quiet, and is supported largely by orders from the automotive industry. Small manufacturing consumers in other lines are buying sparingly, and in many cases seem willing to pay quantity differentials rather than build up their stocks. The base price is well sustained at 1.70c., Pittsburgh.

Tubular Goods

While general demand for pipe mill products has shown little change, greater activity has developed in the

line pipe market. The Phillips Petroleum Co.'s order, mentioned in these columns last week, amounted to about 14,000 tons of pipe, and went to the Republic Steel Corp. It totaled about 210 miles and called principally for 8½-in. material. The order is for immediate rolling. Spang, Chalfant & Co. have completed production of 1300 tons of 8½-in. pipe for a small line for the Tidewater Oil Corp. Some other projects are said to be in prospect which will become active as soon as weather conditions are more favorable. Bad weather in the Conroe field has affected orders for oil country goods this month, and shipments have fallen behind those of December with some companies. Standard butt-weld pipe continues very quiet, and prices have been disturbed in some territories by the granting of extra discounts by two or three smaller makers. The larger interests seem to be maintaining the market.

Wire Products

None of the producers in this district has issued new schedules following the recent reductions in prices of wire products. However, the market seems to be fairly well defined at recently named levels. Certain revisions in the extras on spring wire are expected to be announced in the near future. Quantity differentials for small lots continue to apply. Orders have declined materially since the reduction in price.

Sheets

Specifications have been lighter in the last week, and mill schedules have declined a point or two to about 18 per cent of capacity. Suspension of shipments to body builders in the Detroit district which are affected by labor difficulties, as well as to the Ford Motor Co., have resulted in practical suspension at a few plants which were depending heavily upon this business. The other automobile companies continue to take sheets in fair volume, and February schedules promise little if any curtailment from January. Demand for sheets from other sources continues very quiet.

Definite signs of price stabilization are still lacking, and quotations on some grades of sheets are still largely nominal. Galvanized material is more freely available at 2.60c., Pittsburgh, and 2.50c. has been quoted in some sections of the country. Hot-rolled annealed sheets are fairly well held at 2c., Pittsburgh, with some tonnage bringing 2.10c. Light cold-rolled material is rather freely available at 2.25c. in the Detroit territory. Tin mill black plate is still quoted at 2.30c., Pittsburgh, to the enameling trade, but lower figures are still common on other classes of business. Ordinary hot-rolled material is weak, but not quotably lower in this district.

Tin Plate

Specifications are holding up fairly well, but operations have declined slightly under the 45 per cent level

which prevailed last week. Curtailment has occurred principally in plants which were manufacturing tonnage for stock. Some buyers are still postponing 1933 contracting, but mills are exerting little pressure in this direction. The base price appears to be firm at \$4.25 a base box, Pittsburgh.

Strip Steel

Labor difficulties in the Detroit district have also affected the strip market, as parts makers have held up shipments to some producers. Most of the smaller strip makers are running every other week, and current schedules indicate a production rate of about 20 per cent of capacity. The price on hot-rolled strip is still being held at 1.45c., Pittsburgh, but cold-rolled material has been subject to further weakness. Sizable inquiries have brought out prices \$2 to \$3 a ton under the recent minimum of 1.90c., Pittsburgh.

Coal and Coke

Shipments of furnace coke have been slightly heavier in the last week or two, but the foundry grades continue rather dull. Heating coke is also quiet, and is adversely affected by unseasonably warm weather. The coal market is very quiet, and prices are soft.

Scrap

Despite the failure of steel ingot production in the Pittsburgh district to rise materially, and consequent lack of consumer demand for No. 1 heavy melting steel, the market on this grade is very strong. At the same time, the cheaper open-hearth grades, such as No. 2 steel and machine shop turnings, are in even better demand. The tendency to mix these grades with premium materials and thus reduce scrap costs has been growing, and another mill has placed an experimental order for No. 2 material. This grade is now quoted at \$7.25 to \$7.75, with dealers paying as high as \$7.50 to cover old orders in some instances. Nevertheless, a small tonnage of local scrap has been sold into consumption at \$7.25 or less. Machine shop turnings are quatably unchanged, but dealers are paying \$6.25 and better to cover old orders, and this grade of scrap is very scarce. No recent sales into consumption are reported, but the dealers buying level seems to justify a 50c. spread in the quotations. Railroad specialties are also strong in the absence of offerings. The monthly list of the Pennsylvania Railroad, closing on Feb. 1, contains 30,000 tons, including 10,000 tons of No. 1 heavy melting steel. The Baltimore & Ohio list, closing Feb. 6, contains 6500 tons of scrap.

Brick adds about 75 per cent in strength to steel supports, scientists of the United States Bureau of Standards have just found, after conducting several experiments with actual construction columns.

Shippers Want General Reduction of Freight Rates Immediately

WASHINGTON, Jan. 31—Forestalling of continued freight surcharges is believed to be one of the principal purposes of the joint petition filed last week with the Interstate Commerce Commission by the agricultural, coal and lumber interests asking for immediate and general reduction of freight rates on basic commodities. While request is made for reduction of prevailing rates, it has been observed that the petition was filed at a time when the railroads are seeking continuation of the surcharges which would otherwise expire on March 31. A hearing on the surcharges will be held in Chicago beginning on Thursday of the present week.

The plea for reduced rates was made by the American Farm Bureau Federation, the Farmers' Education and Cooperative Union of America, the National Grange, the National Coal Association and the National Lumber Manufacturers' Association. The petitioners sought to have the commission recognize the existence of a "serious public emergency" and the importance of the freight rate level in that connection. The Federal body was asked to require the rail carriers to appear at once and "show cause why they should not be required immediately to reduce rates."

It was requested that the commission proceed without burdening the public with the cost and expense of any further public hearings. However, the commission, it has been pointed out, would likely take a petition of this kind under consideration without the formality of public hearings, though they might be shortened.

"Since the beginning of the depression and despite all corrective efforts prices on nearly all commodities have continuously and materially declined," the petition said. "There has not been a corresponding decline in the cost of transportation by rail."

This situation was said to have set up "a process of destruction which must be arrested before the industries called upon to pay excessive transportation charges are completely destroyed."

Machine Tool Business Gained in January

Preliminary reports indicate that the index of the National Machine Tool Builders' Association for January will show a rise, perhaps of several points, and that aggregate sales for the first month of 1933 may, in fact, be the best in several months.

The index, which is based on average monthly shipments for 1922, 1923 and 1924 at 100, stood at 35.8 for De-

cember against 32 for November, which in turn had gained from 27.4 in November. The highest figure for any month in 1932 was 59.1, which was recorded in January. The low point was 25.3 in July.

Foreign orders have helped out the past month's aggregate business. An Eastern machine tool builder received a fairly substantial order from Italy. Japanese and Russian orders also have been booked.

A sale of 16 automatic screw machines, referred to last week, was made by the National Acme Co., Cleveland, to the A C Spark Plug Co., Flint, Mich., subsidiary of General Motors Corp. These machines will be equipped with the Chronolog idle time recording device.

Racine, Wis., is reported to have bought 12 tools for its schools. A list of items to be bought for Milwaukee schools is as follows:

2	14-inch engine lathes
3	single cylinder planers
1	wood turning lathe, 12 in. x 60 in.
2	wood turning lathes, 8 in. x 36 in.
2	12-in. jointers
1	mortiser, $\frac{1}{2}$ in.
1	No. S-2 shaper, 5/16-in. arbor
1	Carter R-router
1	motor-driven surface sander
1	motor-head oil stone grinder
1	motor-driven single end tenoner
1	wood turning lathe, 12 x 48 in.

United Chromium, Inc., Wins Patent Suit

The validity of a patent for chromium plating issued to Dr. Colin G. Fink in 1926 and held by United Chromium, Inc., New York, was upheld by a decision of the United States Supreme Court on Jan. 23, as announced in a Washington dispatch published in THE IRON AGE of Jan. 26. The Washington report was in error, however, in stating that the suit in question had been brought against United Chromium, Inc., and in implying that the patent had been based on a formula prescribed in a paper prepared by George J. Sargent in 1920.

The action of the Supreme Court on Jan. 23 was the final outcome of a suit for infringement brought by United Chromium, Inc., against the International Silver Co., which was originally heard in the Federal Court for the District of Connecticut in June, 1930, and which resulted in a decision sustaining the patent.

An appeal was taken to the Circuit Court of Appeals for the Second Circuit, which on July 29, 1932, handed down an opinion reaffirming the validity of the patent. A petition by the appellants for a rehearing was denied and this was followed by a petition for a writ of certiorari to the Supreme Court, and was denied on Jan. 23.

Chicago Ingot Production Rises Sharply to 18 Per Cent

Broadening of Miscellaneous Orders Apparent—Bar Specifications the Best for Any Week This Year

CHICAGO, Jan. 31.—Ingot production is making additional gains, the average in the district now being close to 18 per cent of capacity, an increase of four points in a week. Automobile plants still contribute the bulk of the releases, but forge plants, making parts for tractors, as well as tractor manufacturers themselves, and a broadening of miscellaneous orders are playing a more important part in the market. Some bar mills report the best sales of the new year, and it is generally agreed that inquiries are decidedly improved.

Rail programs are a possibility in the next 30 days. Track accessory sales have gained in recent days. Demand for semi-finished steel is showing a moderate upswing. The desire to store crude oil at present low prices is acting as a stimulant to the plate market, though at the moment fabricators and tank buyers are rather far apart on price agreements. The scrap market is marking time, with dealers casting an anxious eye to the speculative side of the situation.

Prices for all commodities remain unchanged except for lower prices on small rivets and galvanized sheets.

Pig Iron

January shipments gained slightly over those of December and releases at hand indicate a still better movement in the new month. It is important that some of the larger users are again in the market and they have longer schedules than for many months. A Michigan melter has ordered 700 tons of malleable. Other tonnages bring total sales to a parity with those of recent weeks.

Bolts, Nuts and Rivets

Small rivets are being marked down to 70, 10 and 10 per cent off list. January shipments of bolts, nuts and rivets fell below those of December, and prospects for improvement are not bright. Jobbers are releasing a few small lots.

Rails and Track Supplies

Moderate releases of rails against old commitments are permitting both of the Chicago district rail mills to operate, and small schedules are at hand for the coming week. Reports are again current that rail programs are taking shape, and mills are under the impression that tonnages will be out for figures in about 30 days. The Northern Pacific has ordered 1000 tons of tie plates from a Pacific Coast mill and 200 tons of angle bars from Chicago producers. Shipments of accessories are steady and sales show moderate growth.

Cast Iron Pipe

This market remains dull pending action on the Wilmette, Ill., and Chicago tonnages. Both railroads and public utilities are very quiet. Some scattered tonnage is in sight from projects that will be financed by the R. F. C. Prices are steady.

Bars

New business in bars continues to show greater diversification as to users. Support from automobile manufacturers is steady, except from several makers in the high-price field. Forge shops are taking on added life; most of their increase in production going to tractor builders. The farm implement trade is quiet. On the whole, bar sales and specifications are heavier, the week having been the best so far this year.

Reinforcing Bars

Contractors for Illinois road work are placing tonnages and dealers' books are heavier by about 700 tons. The contractor for the Wilmette, Ill., water works has also placed the needed bars. Fresh inquiries are few in number and most of them are for scattered Government work. The urge to raise prices seems once again to be in the air, though no dealer has taken the initiative. Changes in prices would be afforded little test in the present slow market.

Wire Products

Sales continue to hold an upward trend and specifications are moderately larger. Mill output is close to 20 per cent of capacity with good prospects of growth in the near future. Prices still show soft spots as sellers feel for the market level. Moderate improvement is noted in orders from jobbers.

Plates

Of outstanding interest in this market is an inquiry for 7200 tons of plates for oil storage tanks that are planned for erection in the Oklahoma fields. This development comes as a result of low prices for crude oil, it being estimated that a 25c. per bbl. increase in the crude oil price would pay for the tanks. The buyers have named a figure for these tanks that so far is too low to attract fabricators. A sizable tonnage of tanks is being considered for breweries, but exact needs are difficult to determine, because many bidders are after each project. The railroad equipment market is dead. It is estimated here that fully 95 per cent of available used equipment parts have been taken

out of the market by the railroads. This is encouraging to parts manufacturers.

Structural Material

With the exception of an inquiry for a bridge by the Southern Pacific, the structural market has again fallen back to the point where it relies for tonnages on projects that are promoted on public funds. Opinion in and around Chicago is that this situation cannot last much longer and that public work will dwindle as the season advances. Bids taken in December on Illinois bridges have been thrown out and will be readvertised.

Sheets

Galvanized sheets have given further ground to 2.60c. a lb., Chicago district mill. Quotations on bundled and the manufacturing product are holding fairly well, but roofing sheets are under severe pressure. Prices in Chicago show a greater degree of stability than to the South and East. Lower quotations prevail on most grades. Miscellaneous manufacturers are taking a larger tonnage in the aggregate.

Scrap

Heavy melting steel is moving more frequently to mills, but supplies are proving adequate. The result is that prices remain stationary. Some brokers are viewing the market with an eye to speculation. However, heavier buying by consumers must appear on the horizon before dealers will begin to gamble with what credit is available to them. There is a fair call for cast iron wheels. Steel foundries are taking some more scrap, but gray iron units are dormant. Cast iron borings are quiet, with no visible increase in the supply available.

Boston Trade Still Quiet; Scrap Going to Danzig

BOSTON, Jan. 31—The last day of January finds no improvement in pig iron buying and with comparatively little business in sight for the first quarter. Sales the past week included a round tonnage of No. 2X Alabama iron at \$10.50 a ton, furnace, and small lots of Mystic, Buffalo and Indian irons. The price situation is unchanged.

Within the near future a steamer will load 3000 tons of scrap here for Danzig. The current movement of scrap is very light, even buying for barge shipment to Philadelphia having dried up. New England foundries are buying textile machinery and No. 1 machinery cast in truck loads from local or nearby yards.

The Blakeslee-Rollins Corp., Boston, has awarded 450 tons of steel sheet piling to the Bethlehem Steel Co. for Government work at Chelsea, Mass., and 50 tons of bolts, washers, fabricated steel, etc., to other concerns.

Eastern Pennsylvania Trade Shows No Signs of Revival

Prices Still Marked by Irregularities Particularly on Plates, Sheets and Cold-Rolled Strip

PHILADELPHIA, Jan. 31—With the market showing no revival and the price structure still reflecting sharp irregularities, especially in cold-rolled strip, plates and sheets, the trade is eagerly hoping for an early development looking to a pick-up in business and stabilized levels. While it is evident that in some sections of the trade sentiment has improved, on the whole there is no expectation of a marked upswing in the near future. Where a better feeling does exist it does not appear to be based on tangible ground, but is partially due to the approach of a new Federal administration. It is felt that the political position has become extremely difficult with constructive legislation tied up on the eve of a change in policy and that the determination of a definite program, even if not wholly agreeable, will be preferable to the present uncertainty.

The weakest price situation in this district is in plates and sheets. Plates take a range of 1.50c. to 1.60c., Coatesville, while an indication of the slump in sheets is the commonly quoted level of 2.50c., Pittsburgh, on No. 24 galvanized material.

Steel output has declined one point to 11 per cent. This is due to the closing down of three open-hearth furnaces which were operated most of last week by one plant and the starting of one open-hearth furnace by another plant. A nearby maker will start a small structural shape mill tomorrow.

Pig Iron

Miscellaneous inquiry for carlots of foundry iron shows a slight gain and the market remains steady with No. 2 plain quoted at \$12.50, furnace. It is reported that offerings of Japanese iron have been withdrawn despite the low level of \$11.50, landed, at which they were available. Sales in this district of Japanese iron totaled about 600 tons. German ferromanganese still is offered at \$62, Eastern seaboard. This is \$6 under the domestic price, but so far as can be learned none of the German material has been sold in this district. One reason assigned is that the foreign sellers require cash in a German bank against shipping documents. It also is said that the alloy is below the 78 to 82 per cent standard.

Plates, Shapes and Bars

The plate market is unsettled, with the price range at 1.50c. to 1.60c., Coatesville. Structural shapes appear to be fairly well established at 1.60c., Eastern mill, while merchant

steel bars are in a stronger position than either plates or shapes. The bar price remains at 1.60c., Pittsburgh. Actually, however, no large buying has taken place to test the level. Spang, Chalfant & Co., Pittsburgh, were awarded the contract for caissons for the customs house in Philadelphia, requiring about 2500 tons of pipe. The Virginia Ferry Corp. is considering estimates on a ferry, requiring 700 tons of plates, and may make an award this week.

Sheets and Strip

Irregularity continues in the market for sheets and cold-rolled strip steel. Makers are openly quoting No. 24 galvanized sheets at 2.50c., Pittsburgh. No. 10 hot-rolled is fairly firm at 1.45c., though a concession of 10c. per 100 lb. is available to the larger buy-

ers, including the automobile trade. No. 24 hot-rolled annealed is holding at 2c. Hot-rolled strip is fairly steady at 1.45c. Local automobile body builders are buying sheets and strip in fair volume, though not so extensively as had been expected.

Warehouse Business

Jobbers report that January business will slightly exceed that of December. Demand is small, however. Prices are unchanged. Imports continue to be a disturbing factor.

Imports

Imports at Philadelphia last week consisted of 2044 tons of pig iron from the Netherlands and 502 tons of the same product from Asia; also 984 tons of chrome ore from Greece.

Scrap

Export sales are the outstanding feature of the market for scrap. The Charles Dreifus Co. is about to load a cargo of No. 1 heavy melting for shipment to Japan. This will be the first cargo of this grade of scrap shipped from Philadelphia to Japan since 1920. Domestic sales have temporarily eased off, but prices are unchanged and fairly firm, some indicating an upward tendency.

Continental Steel Prices Easier on Slackening of Far Eastern Demand

LONDON, ENGLAND, Jan. 30 (*By Cable*). — Cleveland pig iron makers have fixed home zone prices for No. 3 iron at 62s. 6d., delivered local consumers. The export price is unchanged at 58s. 6d. f.o.b. Pig iron demand is quiet. Steel business is improving on increased shipbuilding and dominion demand for heavy material.

Tin plate is quiet, but output is at 70 per cent of capacity. Some mills have good order books and are holding to 16s., base, f.o.b. works port, but some prompt business has been down as low as 15s. 7½d.

Continental steel prices have eased on slackening of Far Eastern demand and uncertainties regarding the reorganization of the Continental Raw Steel Cartel. Recent purchases for the Far East include 35,000 tons of Belgian and French plates and sheets and quantities of German sheet bars and wire rods.

Early agreement is expected on the proposed renewal of the Italian Joists and Wire Rod Cartel, as the Italian Government is urging a six-months renewal.

Poland and Soviet Russia have concluded a preliminary contract for 25,000 tons of Polish steel.

Russia expects this year to blow in 15 blast furnaces and erect five others. The Russian production program for 1933 provides for 9,000,000 tons of

pig iron, 8,900,000 tons of raw steel and 6,200,000 tons of rolled steel.

British Prices, f.o.b. United Kingdom Ports

Per Gross Ton

Ferromanganese,	£9
export	£9
Billets, open-hearth	£4 17s. 6d. to £5 7s. 6d.
Black sheets, Japanese specifications	£11
Tin plate, per base box	15s. 9d. to 16s.
Steel bars, open-hearth	£7 17½s. to £8 7½s.
Beams, open-hearth	£7 7½s. to £7 17½s.
Channels, open-hearth	£7 12½s. to £8 2½s.
Angles, open-hearth	£7 7½s. to £7 17½s.
Black sheets, No. 24 gage	£8 5s.
Galvanized sheets, No. 24 gage	£10 10s. to £10 15s.

Continental Prices f.o.b. Continental Ports

Per Metric Ton, Gold £ at \$4.86

Billets, Thomas..	£2 1s.
Wire rods, No. 5 B.W.G.	£4 10s.
Black sheets, No. 31 gage, Japanese	£11 5s.
Steel bars, merchant	£2 7s. to £2 8s.
Beams, Thomas..	£2 2s. 6d. to £2 3s.
Angles, Thomas, 4-in. and larger	£2 7s.
Angles, small....	£2 9s.
Hoops and strip steel over 6-in. base	£3 7s. 6d. to £3 10s.
Wire plain, No. 8.	£5 7s. 6d.
Wire nails.....	£5 10s.
Wire, barbed, 4-pt. No. 10 B.W.G.	£8 15s.

Cleveland Ingot Rate Reduced; Ford Shutdown Curtails Output

One Producer Takes Off Two Open-Hearth Furnaces—Finishing Mill Schedules Also Affected

CLEVELAND, Jan. 31.—Demand for finished steel showed little change the past week. While there was not much new business from the motor car industry, miscellaneous orders improved slightly with some of the mills. January as a whole, aside from business from automobile manufacturers, has not brought much revival in the steel industry.

A setback in specifications resulted this week because of the shutdown of the plants of the Ford Motor Co. That was caused by the suspended operations by the manufacturer of Ford bodies. Shipments by suppliers of steel sheets and strip and forgings and other parts in this territory have been held up and foundries making Ford castings have ordered suspension of pig iron shipments. Finishing mill operations in northern Ohio were curtailed to some extent this week because of the Ford holdups.

This situation, together with a decline in new specifications from other automobile manufacturers, has resulted in a reduction in ingot output in Cleveland this week. The Otis Steel Co. has taken off two open-hearth furnaces, bringing the local output down to 38 per cent of ingot capacity.

The Chesapeake & Ohio Railway has purchased 1100 tons of screw spikes, dividing the business among several makers, and has released specifications for a portion of the spikes. No new inquiries from railroads are pending.

The unusually mild winter weather has permitted the opening of Lake navigation and a Cleveland mill received a shipment of scrap by water from Detroit this week and will ship back a cargo of sheet bars to Monroe, Mich.

Interest in the price situation is centered largely in sheets, which still display considerable weakness, particularly in the galvanized grade. Some makers have not formally met the reduced prices recently named on wire products, and manufacturers' wire is still bringing 2.20c. in some cases.

Pig Iron

Pig iron shipments have been suspended by some foundries making Ford castings, owing to hold-ups by the Ford Motor Co. However, January shipments have been about 25 per cent better than those of December, although slightly less than in October, which was the best recent month. New demand continues very

light. Jobbing foundries in this territory have little work. While the \$15 price is being maintained for foundry and malleable iron for local shipment, the market is weak for delivery to competitive points, with quotations of \$13.50 to \$14.

Sheets

Prices continue unsettled, with weakness most pronounced on the galvanized grade, which has declined to 2.50c., Pittsburgh. A 300-ton lot for the Cleveland post office is understood to have been placed at around that price, although some of the sheets are not to be delivered for about a year. While No. 24 gage hot-rolled sheets are generally held at 2c. to 2.10c., there are reports of concessions to 1.90c. on that grade. Light cold-rolled sheets appear to be holding to a minimum of 2.30c. Some additional tonnage came from the automotive industry in Michigan during the week, but little new business was placed in

Cincinnati Pig Iron Trade in Small Lots

CINCINNATI, Jan. 31—Reluctance of pig iron consumers to anticipate their needs brought total sales of iron the past week to a level of less than 300 tons, all in carload lots. Shipments against contracts continue at a fair rate, since users appear desirous of cleaning up outstanding commitments. Quotations on Northern iron, delivered in Cincinnati, continue at about \$16.40 and furnaces are refusing to grant any concession. Southern iron is steady at \$13.82, delivered in Cincinnati, but lack of substantial business leaves the price without test. A few stove foundries are operating four days a week, but otherwise the melt is low.

Steel

Despite the suspension of production by a leading maker of low-priced automobiles the past week, miscellaneous demand for finished sheets will keep rolling schedules of district mills at better than 30 per cent of capacity output this week. Weakness of prices continues to have a depressing effect upon future business.

Scrap

Both buyers and sellers of old materials are wary of the current market. Dealers' bids are unattractive to those having scrap to sell and mills are unwilling to pay sufficient to assure dealers a reasonable profit on sales. Small amounts of material are

this territory. Steel barrel manufacturers are doing little, but look for a gain in business in March.

Strip Steel

Specifications for hot-rolled strip are holding close to recent levels but little new business was placed the past week. The price appears steady at 1.45c., Pittsburgh. Cold-rolled strip is quiet.

Bars, Plates and Shapes

An inquiry will be out shortly for the Columbus, Ohio, post office requiring 4000 tons of structural steel. With no new bridge or other public work out for bids, the market is inactive. Inquiry for tanks for the brewing industry continues to come out in large volume, but some of the business has been placed. Prices are firm at 1.65c. Cleveland, for steel bars, and regular prices on plates and shapes seem to be well maintained.

Scrap

A cargo of steel-making scrap shipped by water from Detroit was received by the Corrigan, McKinney Steel Co. early this week. Another local consumer continues to take small lots of steel-making and blast furnace scrap against old contracts. No activity is reported in the Youngstown district. There is no new demand from consumers. Prices are nominal.

moving on old commitments, but new business is in odd lots.

St. Louis Pig Iron Dull; Steel Mill Buys Scrap

ST. LOUIS, Jan. 31.—While shipments against contracts of the local pig iron maker are reported to be well maintained, new business amounts to very little, being principally carload lots. Some business is expected shortly from the stove manufacturers, whose melt now is exceedingly small. The local maker's price f.o.b. Granite City continues at \$17.50, although competition of both Northern and Southern makers is met as it arises.

Steel

Weakness in wire products and sheets has tended to upset the market for other steel items. However, mills are holding firm to present quotations on plates, shapes and bars. There has been a let-up in the call for bids for highway bridge work in the Southwest, and projects already awarded are being very slowly developed into contracts with fabricators.

Scrap

Another mill in the St. Louis industrial district came into the market during the week for an undetermined tonnage of heavy melting steel at present prices. Prices are nominally unchanged. Railroad lists: Pennsylvania, 29,000 tons; Mobile & Ohio, 5 to 10 carloads.

Further Weakness in Sheets in New York Market

Galvanized Material Much Lower—Cold-Rolled Strip Also Declines—Business Volume Not Much Improved

NEW YORK, Jan. 31.—Little of moment has occurred during the past week in local steel trade except for a further weakening in prices of some grades of steel sheets, a decline of about \$3 a ton on cold-rolled strip steel and a more definite alinement of prices on plates from Eastern mills. The volume of business has not improved materially in the past week, though most mill representatives report that the aggregate tonnage in January showed an improvement over that of December.

Among sheet mill products, galvanized material has shown the most marked weakness. Some mills are soliciting business at 2.50c. a lb. Pittsburgh, and sales have been made at prices even below that figure. No. 10 gage hot-rolled annealed has weakened from the 1.45c. price that has been in effect the past few weeks, a few sales having been made at 1.40c. Efforts to stabilize the sheet market are understood to be in progress, but meanwhile some sellers are out for business without definite prices, meeting competition as it develops. Cold-rolled strip steel has been sold at 1.75c., Pittsburgh or Cleveland, a decline of \$3 a ton from the recently published minimum.

On plates from Eastern mills, 1.60c., Coatesville, now is the top of the market, being quoted for small lots, while prices from 1.40c. to 1.50c. are quoted on the more attractive tonnage. Pittsburgh and Ohio mills are meeting competition when necessary. Newark, N. J., is taking bids on 1100 ft. of 48-in. pipe. A western Pennsylvania fabricator has received an order for tanks for a New York brewery, requiring upward of 200 tons of plates.

Pig Iron

The final week in January brought no change from the extreme dullness of preceding weeks. Bookings of only 600 tons for the week lifted the month's total to a meager 3000 tons, probably the smallest for any month during the current depression. Shipments during the month barely outpaced sales. This situation is ascribable to the small number of unfilled orders and to the spot character of buying. Steadiness of prices throughout the month is laid partly to somewhat abated pressure of foreign competition and to the lack of round-lot inquiry. Recent offerings of Manchurian pig iron here have been withdrawn. A cargo of 3000 to 4000 tons of Royal Dutch pig iron is being discharged at Bridgeport, Conn. No specific inquiries are reported.

Reinforcing Bars

Interest has been enlivened by several large prospective lettings during the coming month. The largest of these is the New York Central Railroad freight terminal at New York, which will take about 2250 tons. A two-mile suspension bridge over the Connecticut River at Hartford is expected to require a substantial tonnage. Readvertised bids on the United States Marine Hospital at Stapleton, N. Y., involving about 500 tons, will be opened on Feb. 17. Awards for the week totaled about 1100 tons, most of which was for State highway construction in New York. A severe test of prices, which continue soft, is expected in bidding on the major tonnages that are now pending.

Scrap

Competitive bidding by brokers with export commitments has stiffened the price of No. 2 heavy melting steel, which is now quotable at \$3.50 to \$4 a ton, on barge. Even the higher price has failed thus far to draw out much tonnage. No. 1 heavy melting steel, while unchanged at \$5, on barge, reflects a strong tone. Export movement of these grades, which in the past three months is estimated to have involved about 20,000 to 25,000 tons of No. 2 and about 10,000 tons of No. 1, has caused a measurable shrinkage of available supplies in the district. An early expansion in domestic demand, therefore, would likely tend to strengthen further the values of the heavy melting grades. Domestic interest at present, however, is dormant and shows little evidence of awakening, at least in the immediate future.

Birmingham Steel-Making Rate at 30 Per Cent

BIRMINGHAM, Jan. 31.—The last half of January brought a slight upturn in pig iron shipments, but the month as a whole was unsatisfactory and only slightly better than December, which was one of the poorest months that Birmingham has had in many years. The market is at an extremely low point and early prospects are not cheerful. Foundry operations are just as irregular as during the fall. It is expected that February will provide a small increase in iron consumption, but this will not be sufficient to change the tone of the market

to any extent. The pressure pipe outlook is somewhat better, although present business is still limited. Inquiries have picked up and pipe officials say that prospects are better than at this time last year. Two blast furnaces are active, no changes having occurred since the first of the year. Quotations of \$11 for the Southern market are unchanged.

Steel

The Ensley rail mill of the Tennessee Coal, Iron & Railroad Co. started up on Monday for the first time since last May. Its operation will be only for the present week. About 6000 tons will be rolled. Part of this is newly booked business and part releases against old contracts. Raw steel will be brought over from the Fairfield works, so there will be no blast furnace or open-hearth activity at Ensley.

Price weakness is bringing the usual hesitancy even for routine business. The reductions of from \$2 to \$6 in wire products have not stimulated demand. January bookings were ahead of those for December, largely because of the holiday and year-end stoppage and not because of any material market improvement.

Open-hearth operations gained one unit last Wednesday and six were active during the remainder of the week. This week there is another increase, and seven units are being operated, or about 30 per cent of district capacity. The increase is due to the reopening of the rail mill and probably will not hold after this week.

Buffalo Pig Iron Sales Hurt By Foreign Iron

BUFFALO, Jan. 31.—Pig iron sales are confined to small lots. No large inquiries are out. The influx of foreign iron has now almost completely destroyed the Eastern market.

Steel

Five open-hearth furnaces are being continued in operation at the Lackawanna plant of the Bethlehem Steel Corp. The Republic Steel Corp. plant is idle this week. One open-hearth furnace is being operated by Wickwire Spencer. A Buffalo fabricator has obtained a structural steel contract for a new kiln and furnace for the United States Gypsum Co. at New Brighton, N. Y., amounting to 190 tons.

Scrap

A local mill is understood to have purchased approximately 2000 tons of rails classed as No. 1 heavy melting steel from a railroad. On an old order of No. 1 and No. 2 heavy melting steel, shipment on which has been held up for over a year, a local dealer is said to have accepted a compromise price on the original \$8 contract.

Fabricated Structural Steel

Awards Decline—New Projects in Good Volume

BOOKINGS of 6500 tons again were mostly for public work and compare with a total of 9100 tons in the previous week. The largest award is 2200 tons for a bridge at Rutherford, N. J., over the Hackensack River. New projects call for 29,000 tons, compared with 5000 tons a week ago. More than half of this total, 17,000 tons, will be required for a bridge at Hartford, Conn., over the Connecticut River, for which bids will be taken March 13. An annex to the post office at New York calls for 5000 tons. Awards follow:

NORTH ATLANTIC STATES

Alsen, N. Y., 135 tons, Alpha Portland Cement Co. building, to Lehigh Structural Steel Co.
Port Chester, N. Y., 110 tons, post office, to Ingalls Iron Works.

State of New Jersey, 2200 tons, bridge over Hackensack River at Rutherford-Secaucus, to American Bridge Co.

New Brighton, N. Y., 190 tons; kiln and furnace for United States Gypsum Co., to Lackawanna Steel Construction Corp.

Rome, N. Y., 140 tons, New York State school, to Pittsburgh Bridge & Iron Works.

SOUTH AND SOUTHWEST

Clearwater, Fla., 110 tons, post office, to Ingalls Iron Works.

State of Florida, 200 tons, St. Lucie River bridge, to Virginia Bridge & Iron Co.

Harvey, La., 572 tons, buildings for Freeport, Texas Sulphur Co., 422 tons to Virginia Bridge & Iron Co., 150 tons to Ingalls Iron Works.

CENTRAL STATES

Fern Bank, Ohio, 310 tons, lock gates in Ohio River, to Midland Barge Co.

Randolph County, Ill., 270 tons, beam bridges, to Wisconsin Bridge & Iron Co.

Homer, Neb., 130 tons, Chicago, Burlington & Quincy Railroad bridge, to American Bridge Co.

WESTERN STATES

Jensen, Utah, 500 tons, bridge, to McClintic-Marshall Corp.

San Francisco, 950 tons, post office addition, to McClintic-Marshall Corp.

Routt County, Colo., 238 tons, State highway bridge between Hayden and Mt. Harris, to an unnamed bidder.

Beverly Hills, Cal., 360 tons, post office, to McClintic-Marshall Corp.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

Hillboro, N. H., 200 tons, State bridge over Contoocook River.

Oxford, Mass., 125 tons, State bridge.

Revere, Mass., 100 tons, State bridge.

Hartford, Conn., 17,000 tons, suspension bridge over Connecticut River bids to be taken March 18 by Connecticut State River Bridge Commission, R. A. Johnson, chairman, Hartford.

New York, 5000 tons, post office annex, bids to be opened Feb. 28 by Supervising Architect, Treasury Department, Washington.

New York, 21,000 tons, St. John's Park freight terminal for New York Central Railroad; James Stewart & Co., Inc., low bidder for general contract.

Mt. Vernon, N. Y., 350 tons, building for Snow White Laundry.

Stapleton, N. Y., 2400 tons, United States Marine Hospital; bids readvertised for Feb. 17.

Bloomfield, N. J., 100 tons, post office; bids Feb. 16.

Erie Railroad, 210 tons, bridge at Endicott, N. Y.

Albany, N. Y., 260 tons, transit shed No. 3 for Albany district port commission.

Newark, N. J., 200 tons, building for Frank G. Shattuck Co.

Baltimore, 135 tons, science and library building for Loyola High School.

SOUTH AND SOUTHWEST

State of Virginia, 600 tons, Staunton River bridge, Wisconsin Bridge & Iron Co. low bidder.

Paducah, Ky., 200 tons, bridge.

Barren River, Ky., 450 tons, lock and dam, previously reported as 200 tons.

Tyler, Tex., 385 tons, post office; Ralph Sullitt Co., Chicago, low bidder.

State of New Mexico, 500 tons, highway bridges.

State of New Mexico, 335 tons, highway bridge at Watrous.

CENTRAL STATES

Columbus, Ohio, 4000 tons, post office, previously reported as 2500 tons.

Randolph County, Ill., 265 tons, three bridges; Vincennes Bridge Co. low bidder.

State of Illinois, 500 tons, bridges; will advertise bids taken in December.

Milwaukee, United States Engineer Office, 100 tons, lock gates, etc., for Kaukauna lock; bids Feb. 15.

WESTERN STATES

Walsenburg, Colo., 250 tons, bridge.

Yuma, Ariz., 200 tons, post office, bids under advisement.

Seattle, 660 tons, Mount Diablo power house and transmission line.

Castella, Cal., 700 tons, bridge for Southern Pacific Railroad.

FABRICATED PLATE

AWARDS

Philadelphia, 2500 tons, lap weld pipe for custom house, to Spang-Chalfant Co., Pittsburgh.

Luddington, Mich., 125 tons, 300,000-gal. tank and tower, to Pittsburgh-Des Moines Steel Co.

Harvey, La., 300 tons, tanks for Freeport, Texas Sulphur Co., to Chicago Bridge & Iron Co.

NEW PROJECTS

New York, 300 tons, St. John's Park freight terminal for New York Central Railroad; James Stewart & Co., Inc., New York, low bidder for general contract.

Milwaukee, unstated tonnage, four 1,000,000-gal. crude oil storage tanks for unnamed interest on city outer harbor property; bids soon.

Pipe Lines

Department of Public Affairs, City Hall, Newark, N. J., will receive bids until Feb. 9 for about 1800 ft. of steel pipe, 5/8-in. plate, for Pequannock conduits, Division of Water, with alternate bids as follows: (a) 50-in. riveted steel pipe, 7 1/2-ft. courses; (b) 48-in. lock-bar steel pipe, 30-ft. courses; (c) 48-in. riveted steel pipe, 30-ft. courses; (d) 48-in. hammer-welded steel pipe, 30-ft. courses.

United States Engineer Office, Kansas City, Mo., asks bids until Feb. 9 for two sections electric welded steel pipe 23 1/4-in. inside diameter, steel pipe with steel flanges on each end, and two steel pontoons with pivot bearing pipe carriers.

Gettysburg Gas Co., Gettysburg, Pa., plans extensions of pipe lines in different parts of Franklin and Adams counties.

Natural Gas Pipe Line Co. of America, Inc., 20 North Wacker Drive, Chicago, plans steel pipe line to Osceola and Chariton, southern part of Warren County, Iowa, about 30 miles.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Feb. 14 for 8120 ft. welded steel pipe for Puget Sound Navy Yard (Schedule 9512).

Vancouver, B. C., awarded 850 tons of steel pipe to Dominion Bridge Co., previously reported as 450 tons.

Reinforcing Steel

Awards 3000 Tons—New Projects 3100 Tons

Westchester County, N. Y., 700 tons, highway construction; 400 tons to Wheeling Steel Corp., and 300 tons to Kalman Steel Corp.

Suffolk County, N. Y., 150 tons, highway construction, Sunrise Highway, to National Bridge Works.

Newark, N. J., 250 tons, sub-section 2, section 1, city subway, to Faitoute Iron & Steel Co.

Washington, 500 tons, Government central heating plant, to Rosslyn Steel & Cement Co.

State of Illinois, 700 tons, road slab work, to various jobbers.

Milwaukee, 105 tons, United States Engineer's office, to Joseph T. Ryerson & Son, Inc.

Wilmette, Ill., 365 tons, waterworks, to Truston Steel Co.

Alameda County, Cal., 226 tons, State highway between Dublin and Castro Hill, to Soule Steel Co.; previously reported to Truston Steel Co.

Clatsop and Jackson counties, Ore., 104 tons, State highway bridges, to an unnamed bidder.

Santa Maria, Cal., 100 tons, reservoir, to an unnamed bidder.

Oak Park, Ill., 150 tons, post office, to Joseph T. Ryerson & Son, Inc., previously reported to Inland Steel Co.

NEW REINFORCING BAR PROJECTS

Hartford, Conn., unstated tonnage, bridge over Connecticut River; bids to be taken March 13 by Connecticut State River Bridge Commission, R. A. Johnson, chairman, Hartford.

West Point, N. Y., 169 tons, barracks.

Rochester, N. Y., 350 tons, addition to State hospital.

New York, 2250 tons, St. John's Park freight terminal for New York Central Railroad, previously reported as 250 tons; James Stewart & Co., Inc., low bidder for general contract.

Stapleton, N. Y., 500 tons, United States Marine Hospital; bids readvertised for Feb. 17.

Washington, 195 tons, alteration to non-commissioned officers' apartments and addition to nurses' quarters, Walter Reed Hospital.

St. Paul, Minn., 150 tons, post office.

Rantoul, Ill., tonnage being estimated, air corps barracks.

Columbus, Ohio, tonnage being estimated, post office.

Fort Worth, Tex., 300 tons, Federal building.

Cast Iron Pipe

Hempstead, N. Y., took bids recently on about 2000 tons of 4- to 24-in.

Massachusetts closes bids Feb. 2 on 2116 tons of 20-in. cement lined bell and spigot pipe, 53 tons of special castings.

Boston has awarded 150 tons of branches and curves to Warren Foundry & Pipe Corp.

West Virginia Water Service Co., Summers Street, Charleston, W. Va., plans new pipe line from intake on Elk River. Cost over \$85,000.

Pasadena, Cal., has opened bids on about 1400 tons of 6- to 24-in.; American Cast Iron Pipe Co., National Cast Iron Pipe Co. and United States Pipe & Foundry Co. low bidders.

Soledad, Cal., has awarded 200 tons of 4- to 8-in. to United States Pipe & Foundry Co.

Memphis, Tenn., has awarded 350 tons of 6- and 12-in. to United States Pipe & Foundry Co.

Dallas, Tex., has opened bids on 2200 tons; American Cast Iron Pipe Co. and United States Pipe & Foundry Co. low bidders.

Tin Price Gains Half a Cent; Zinc Soft; Lead, Copper Steady

Impetus For Advance in Tin Comes Largely From London—Very Little Activity in Copper

NEW YORK, Jan. 31.—Scarcely a ripple of activity appeared in the domestic copper market during the week. Current buying interest is meager. While most sellers are maintaining postings of 5c. a lb., Connecticut basis, for nearby and 5.12½c. for second quarter delivery, a few minor lots of electrolytic have been sold for shipment into second quarter at 5c. Lake copper is inactive and unchanged at 5c., delivered New York. Buying in European markets, in contrast with domestic activity, has been fairly steady. Foreign prices fluctuated narrowly during the week within a range of 4.97½c. to 5.05c., c.i.f. continental ports. Today's export quotation was steady at 5c. While domestic copper market-wise is drifting, the industry itself is maintaining an even keel. Though actual figures are not available, it is believed that producers' stocks at the close of 1932 showed no increase for the year, indicating that production and consumption were in balance. Domestic shipments last year, according to estimates, averaged about 25,000 tons a month. Deliveries to

foreign consumers, on the other hand, approximated 45,000 tons a month. Talk of segregating American copper stocks has not progressed beyond the conjectural stage.

Copper Averages

The average price of Lake copper for January, based on daily quotations in **THE IRON AGE**, was 5c., delivered New York. The average price of electrolytic copper for that month was 4.75c., refinery, or 5c., delivered Connecticut.

Lead

With bookings in January having reflected no increase over the small volume in December, most producers are sanguine that February will usher in an improved demand. With consumer stocks generally at an irreducible minimum, smelters are under the impression that a substantial volume of potential buying that accumulated in January will be released in the coming month. Interest in February lead has already broadened, with one seller reporting fair bookings in the past few days. Prices are well main-

tained at 2.87½c. a lb., St. Louis, and 3c. New York.

Tin

The New York price of spot Straits jumped 50 points today to 23.50c. a lb. Impetus for this rise came chiefly from a strong London market, which on second call today was up £1 a ton, and from steadiness in sterling exchange. Prior to this rise, the market hovered around 23c. to 23.10c. While a moderate volume of spot buying was done at those levels, consumer interest abated perceptibly today, with the sharp upturn in price. London values also reflected a marked advance for the week, with today's quotations £148 5s. a ton for spot standard, £148 15s. for future standard and £154 for spot Straits. The Singapore market, which was closed most of the week because of Chinese holidays, was slightly higher today at £151 10s. January deliveries of tin to American consumers were about 3700 tons through Atlantic ports and about 2500 tons through Pacific ports.

Zinc

Prices in this market, while not readily definable, reflect softness. Most producers have declared their positions at 2.90c., East St. Louis, or 3.27c., New York, but others are understood to have solicited bids on the basis of 2.87½c., East St. Louis. Transactions at the lower price, however, are not in evidence. The market is, therefore, quotable at a spread of 2.87½c. to 2.90c., East St. Louis, and 3.24½ to 3.27c., New York. Bookings of only 1000 tons in the past week show no change in demand. Reports of a possible dissolution of the International Zinc Cartel have not influenced the domestic market, which is practically divorced from European zinc markets.

General Contracts Let for Army Work in California

SAN FRANCISCO, Jan. 30.—With general contracts awarded for 11 buildings at Fort Miley and a headquarters addition at Fort Mason, involving approximately 2000 and 1500 tons of reinforcing steel respectively, it is expected that steel contracts will be let shortly. The Knights Landing bridge contract was held up by court action for some time, but it is now reported that the suit has been dismissed and work will proceed. This project will require 112 tons of reinforcing bars and 383 tons of structural steel. Although bids were scheduled to be called on the San Francisco Psychopathic Ward on Feb. 15 and on the Cancer Ward in the near future, it is now understood that these two projects are to be delayed indefinitely. Bids are to be taken on Feb. 28 on the Federal Building in San Francisco, which will require approximately 4000 tons of structural steel and 500 tons of reinforcing bars.

The Week's Prices. Cents Per Pound for Early Delivery

	Jan. 25	Jan. 26	Jan. 27	Jan. 28	Jan. 30	Jan. 31
Electrolytic copper, N. Y.*	4.75	4.75	4.75	4.75	4.75	4.75
Lake copper, New York	5.00	5.00	5.00	5.00	5.00	5.00
Straits tin, Spot, N. Y.	23.10	23.10	23.00	...	23.00	23.50
Zinc, East St. Louis	2.95	2.95	2.90	2.90	2.90	2.87½
Zinc, New York	3.32	3.32	3.27	3.27	3.27	3.24½
Lead, St. Louis	2.87½	2.87½	2.87½	2.87½	2.87½	2.87½
Lead, New York	3.00	3.00	3.00	3.00	3.00	3.00

*Refinery quotations; price ¼c. higher delivered in Connecticut.

Aluminum, 98 to 99 per cent pure, 22.90c. a lb., delivered.
Nickel, electrolytic cathode, 35c. a lb., delivered; shot and ingot, 36c. a lb., delivered.
Antimony, 5.80c. a lb., New York.
Brass ingots, 85-5-5, 5.25c. a lb., New York and Philadelphia.

From New York Warehouse

Delivered Prices, Base per Lb.

Tin, Straits pig	25.50 to 26.50c.
Tin, bar	27.50c. to 29.50c.
Copper, Lake	7.50c. to 8.50c.
Copper, electrolytic	7.25c. to 8.25c.
Copper, casting	7.00c. to 8.00c.
*Copper sheets, hot-rolled	13.62½c.
*High brass sheets	11.00c.
*Seamless brass tubes	13.25c.
*Seamless copper tubes	12.37½c.
*Brass rods	8.50c.
Zinc, slabs	4.37½c. to 4.87½c.
Zinc sheets (No. 9), casks	9.25c. to 9.50c.
Lead, American pig	3.75c. to 4.25c.
Lead, bar	5.25c. to 6.25c.
Lead, sheets	6.75c.
Antimony, Asiatic	8.00c. to 9.00c.
Alum, virgin, 99 per cent plus	23.30c.
Alum. No. 1 for remelt-ing, 98 to 99 per cent	16.00c.
Solder, ½ and ⅓	15.50c. to 16.50c.
Babbitt metal, com-matical grade	21.00c. to 32.00c.

*These prices are also for delivery from Chicago and Cleveland warehouses.

From Cleveland Warehouse

Delivered Prices per Lb.

Tin, Straits pig	27.50c.
Tin, bar	29.50c.
Copper, Lake	6.125c.

Copper, electrolytic..... 6.125c.

Copper, casting..... 5.875c.

Zinc, slab..... 4.25c. to 4.50c.

Lead, American pig..... 3.75c. to 4.00c.

Lead, bar..... 7.25c.

Antimony, Asiatic..... 8.50c.

Babbitt metal, medium grade..... 16.50c.

Babbitt metal, high grade..... 31.25c.

Solder, ½ and ⅓..... 17.00c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

Dealers' Buying Prices

Dealers' Selling Prices

Copper, hvy. crucible	3.75c.	4.25c.
Copper, hvy. and wire	3.50c.	4.125c.
Copper, light and bot-toms	2.625c.	3.50c.
Brass, heavy	1.625c.	2.25c.
Brass, light	1.25c.	1.75c.
Hvy. machine com-position	2.50c.	3.00c.
No. 1 yel. brass turn-ings	2.125c.	2.50c.
No. 1 red brass or compos. turnings	2.375c.	3.00c.
Lead, heavy	2.125c.	2.50c.
Zinc	1.25c.	1.625c.
Cast aluminum	3.75c.	5.25c.
Sheet aluminum.....	8.00c.	9.75c.

Prices of Finished and Semi-Finished Steel, Coke, Coal, Cast Iron Pipe

BARS, PLATES, SHAPES

Iron and Steel Bars

Soft Steel

Base per Lb.

Fab. Pittsburgh mill	1.60c.
Fab. Chicago	1.70c.
Fab'd Philadelphia	1.91c.
Fab'd New York	1.95c.
Fab'd Detroit	1.80c.
Fab. Lackawanna	1.65c.
Fab. Birmingham	1.70c.
C.I.F. Pacific ports	1.75c.
	2.10c.

Billet Steel Reinforcing

(as quoted by distributors)

Fab. Pgh mills, 40, 50, 60-ft.	1.50c.
Fab. Birmingham, mill lengths	1.75c.
Fab. Cleveland	1.50c.

Rail Steel

Fab. mills, east of Chicago dist.	1.35c.
Fab. Chicago Heights mills	1.50c.

Iron

Common iron, f.o.b. Chicago	1.60c.
Reinforced iron, f.o.b. Pgh mills	2.75c.
Common iron, del'd Philadelphia	1.86c.
Common iron, del'd New York	1.90c.

Tank Plates

Base per Lb.

Fab. Pittsburgh mill	1.60c.
Fab. Chicago	1.70c.
Fab. Birmingham	1.75c.
Fab'd Cleveland	1.803c.
Fab'd Philadelphia	1.6935c. to 1.7935c.
Fab. Coatesville	1.50c. to 1.70c.
Fab. Sparrows Point	1.50c. to 1.70c.
Fab'd New York	1.693c. to 1.798c.
C.I.F. Pacific ports	2.00c.
Wrought iron plates, f.o.b. Pgh	3.00c.

Structural Shapes

Base per Lb.

Fab. Pittsburgh mill	1.60c.
Fab. Chicago	1.70c.
Fab. Birmingham	1.75c.
Fab. Lackawanna	1.70c.
Fab. Bethlehem	1.70c.
Fab'd Cleveland	1.803c.
Fab'd Philadelphia	1.7495c.
Fab'd New York	1.86775c.
C.I.F. Pacific ports (standard)	2.10c.
C.I.F. Pacific ports (wide flange)	2.20c.

Steel Sheet Piling

Base per Lb.

Fab. Pittsburgh	1.90c.
Fab. Chicago mill	2.05c.
Fab. Buffalo	2.00c.

Alloy Steel Bars

F.o.b. Pittsburgh, Chicago, Buffalo, Massillon or Canton)	
Aloy Quantity Bar Base, 2.45c. to 2.65c. per Lb.	

S.A.E. Series	Differential per 100 Lbs.
Numbers	
2000 (34% Nickel)	\$0.25
2100 (31% Nickel)	0.55
2200 (30% Nickel)	1.50
2300 (50% Nickel)	2.25
2100 Nickel Chromium	0.55
2300 Nickel Chromium	1.35
2400 Nickel Chromium	3.80
2500 Nickel Chromium	3.20
2100 Chromium Molybdenum (0.16 to 0.25 Molybdenum)	0.50
2100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4000 Nickel Molybdenum (0.20 to 0.30 Molybdenum), 1.50	1.05
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45
5100 Chromium Spring Steel	0.20
5100 Chromium Vanadium Bar	1.20
5100 Chromium Vanadium Spring Steel	0.95
2100 Silicon Manganese Spring Steel (flats)	0.25
Rounds and Squares	0.50
Chromium Nickel Vanadium	1.50
Carbon Vanadium	0.95

Above prices are for hot-rolled steel bars, quality. The differential for cold-drawn bars is 3c. a lb. higher, with standard classification for cold-finished alloy steel bars applying. For billets 4 x 4 to 10 x 10 in., the price for a gross ton is the net price for bars of the same analysis.
Billets under 4 x 4 in. carry the steel bar price. Slabs with a section area of 16 in. or over carry the billet price. Slabs with sectional areas of less than 16 in. or less than 2 1/2 in. thick, regardless of sectional area, take the bar price.

Cold Finished Bars*

Bars, f.o.b. Pittsburgh mill	1.70c.
Bars, f.o.b. Chicago	1.75c.
Bars, Cleveland	1.75c.
Bars, Buffalo	1.75c.
Bars, Detroit	1.90c.
Bars eastern Michigan	1.95c.
Shafting, ground, f.o.b. mill	1.95c.

1 3/16 to 1 1/2 in.	3.00c.
1 1/2 to 1 1/4 in.	2.50c.
1 1/4 to 1 1/2 in.	2.35c.
2 1/2 to 2 1/4 in.	2.20c.
2 1/4 to 2 1/2 in.	2.00c.

* In quantities of 10,000 to 19,999 lb.

SHEETS, STRIP, TIN PLATE, TERNE PLATE

Sheets

Hot-Rolled

No. 10, f.o.b. Pittsburgh	1.45c. to 1.50c.
No. 10, f.o.b. Chicago	1.55c. to 1.60c.
No. 10, del'd Philadelphia	1.76c. to 1.81c.
No. 10, f.o.b. Birmingham	1.60c. to 1.65c.
No. 10, c.i.f. Pacific Coast ports	2.17c. to 2.20c.

Hot-Rolled Annealed

No. 10, Pittsburgh	1.60c. to 1.70c.
No. 10, Chicago mills	1.70c.
No. 10, Birmingham	1.75c. to 1.80c.
No. 10, Pacific Coast ports	2.32c. to 2.35c.
No. 10, wrought iron, Pittsburgh	3.00c.

Hot-Rolled Annealed

No. 10, Pittsburgh	1.60c. to 1.70c.
No. 10, Chicago mills	1.70c.
No. 10, Birmingham	1.75c. to 1.80c.
No. 10, Pacific Coast ports	2.32c. to 2.35c.
No. 10, wrought iron, Pittsburgh	3.00c.

Hot Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	1.85c. to 1.95c.
No. 10 gage, f.o.b. Chicago mills	1.95c. to 2.05c.
No. 10 gage, del'd Philadelphia	2.16c. to 2.26c.
No. 20 gage, f.o.b. Pittsburgh	2.25c. to 2.30c.
No. 20 gage, f.o.b. Chicago mills	2.40c. to 2.50c.
No. 20 gage, del'd Philadelphia	2.61c. to 2.71c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	2.25c. to 2.30c.
No. 20 gage, f.o.b. Chicago mills	2.40c. to 2.50c.
No. 20 gage, del'd Philadelphia	2.61c. to 2.71c.
No. 24 gage, f.o.b. Pittsburgh	2.71c. to 2.81c.
No. 24 gage, f.o.b. Chicago mills	2.86c. to 2.96c.
No. 24 gage, del'd Philadelphia	3.06c. to 3.16c.

No. 24 gage, f.o.b. Pittsburgh	2.71c. to 2.81c.
No. 24 gage, f.o.b. Chicago mills	2.86c. to 2.96c.
No. 24 gage, del'd Philadelphia	3.06c. to 3.16c.
No. 24 gage, f.o.b. Pittsburgh	3.06c. to 3.16c.
No. 24 gage, f.o.b. Chicago mills	3.21c. to 3.31c.
No. 24 gage, del'd Philadelphia	3.41c. to 3.51c.

No. 24 gage, f.o.b. Pittsburgh	3.06c. to 3.16c.
No. 24 gage, f.o.b. Chicago mills	3.21c. to 3.31c.
No. 24 gage, del'd Philadelphia	3.41c. to 3.51c.
No. 24 gage, f.o.b. Pittsburgh	3.41c. to 3.51c.
No. 24 gage, f.o.b. Chicago mills	3.56c. to 3.66c.
No. 24 gage, del'd Philadelphia	3.76c. to 3.86c.

No. 24 gage, f.o.b. Pittsburgh	3.41c. to 3.51c.
No. 24 gage, f.o.b. Chicago mills	3.56c. to 3.66c.
No. 24 gage, del'd Philadelphia	3.76c. to 3.86c.
No. 24 gage, f.o.b. Pittsburgh	3.76c. to 3.86c.
No. 24 gage, f.o.b. Chicago mills	3.91c. to 4.01c.
No. 24 gage, del'd Philadelphia	4.11c. to 4.21c.

No. 24 gage, f.o.b. Pittsburgh	3.76c. to 3.86c.
No. 24 gage, f.o.b. Chicago mills	3.91c. to 4.01c.
No. 24 gage, del'd Philadelphia	4.11c. to 4.21c.
No. 24 gage, f.o.b. Pittsburgh	4.11c. to 4.21c.
No. 24 gage, f.o.b. Chicago mills	4.26c. to 4.36c.
No. 24 gage, del'd Philadelphia	4.46c. to 4.56c.

No. 24 gage, f.o.b. Pittsburgh	4.11c. to 4.21c.
No. 24 gage, f.o.b. Chicago mills	4.26c. to 4.36c.
No. 24 gage, del'd Philadelphia	4.46c. to 4.56c.
No. 24 gage, f.o.b. Pittsburgh	4.46c. to 4.56c.
No. 24 gage, f.o.b. Chicago mills	4.61c. to 4.71c.
No. 24 gage, del'd Philadelphia	4.81c. to 4.91c.

No. 24 gage, f.o.b. Pittsburgh	4.46c. to 4.56c.

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Skelp	
(F.o.b. Pittsburgh or Youngstown)	Per Lb.
Grooved	1.60c.
Universal	1.60c.
Sheared	1.60c.

Wire Rods

(Common soft, base)

Per Gross Ton	
Pittsburgh	\$35.00
Cleveland	35.00
Chicago	36.00

COKE, COAL AND FUEL OIL

Coke

Per Net Ton

Furnace, f.o.b. Connellsville	\$1.75 to \$2.00
Promt	\$1.75 to \$2.00
Foundry, f.o.b. Connellsville	2.50 to 4.25
Foundry, by-product, Chicago out for delivery outside switching districts	7.00
Foundry, by-product, delivered in Chicago switching district	7.75
Foundry, by-product, New England, delivered	10.00
Foundry, by-product, Newark or Jersey City, del'd	8.20 to 8.80
Foundry, by-product, Phila.	8.50
Foundry, by-product, Cleve- land, delivered	7.82
Foundry, Birmingham	5.00
Foundry, by-products, St. Louis, f.o.b. oven	8.00
Foundry, by-products, del'd St. Louis	9.00

Coal

Per Net Ton

Mine run steam coal, f.o.b. W. Pa. mines	\$1.00 to \$1.15
Mine run coking coal, f.o.b. W. Pa.	1.10 to 1.25
Gas coal, % in., f.o.b. Pa. mines	1.25 to 1.40
Mine run gas coal, f.o.b. Pa. mines	1.20 to 1.30
Steam slack, f.o.b. W. Pa. mines	0.25 to 0.35
Gas slack, f.o.b. W. Pa. mines	0.35 to 0.45

Fuel Oil

Per Gal. f.o.b. Bayonne, N.J.	
No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

Per Gal. f.o.b. Baltimore

No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

Per Gal. del'd Chicago

No. 2 industrial fuel oil	2.80c. to 2.90c.
No. 5 industrial fuel oil	2.45c. to 2.50c.

Per Gal. f.o.b. Cleveland

No. 3 distillate	5.25c.
No. 4 industrial	4.75c.

REFRACTORIES

Fire Clay Brick

Per 1000 f.o.b. Works

Penn.	\$35.00
Maryland	35.00
N.J. Jer.	\$44.00 to 57.00
Ohio	35.00
Kentucky	35.00
Missouri	35.00
Illinois	35.00
Ground fire clay, per ton	6.50

Chrome Brick

Per Net Ton

Standard size	\$42.50

Silica Brick

Per 1000 f.o.b. Works

Pennsylvania	\$38.00
Chicago	47.00
Birmingham	50.00
Silica clay, per ton	8.00

Magnesite Brick

Per Net Ton

Standard sizes, burned f.o.b. Balti- more and Chester, Pa.	\$61.50
Unburned, f.o.b. Baltimore	52.00
Grain magnesite, f.o.b. Baltimore and Chester, Pa.	38.50
Domestic, f.o.b. Chewelah, Wash.	20.90

CAST IRON PIPE

Per Net Ton

6-in. and larger, del'd	\$40.40 to \$41.40
4-in., del'd Chicago	43.40 to 44.40
6-in. and larger, del'd New York	35.30
4-in., del'd New York	38.30
6-in. and larger, Birmingham	33.00
4-in., Birmingham	36.00

Class "A" and gas pipe, \$3 extra.

Pig Iron, Ores, Ferroalloys

VALLEY

Per Gross ton, f.o.b. Valley furnace:	
Basic	\$13.50
Bessemer	15.00
Gray Forge	14.50
No. 2 foundry	14.00
No. 3 foundry	14.00
Malleable	14.50 to 15.00
Low phosph., copper free	23.00 to 25.00

Freight rate to Pittsburgh or Cleveland
district, \$1.89.

PITTSBURGH

Per Gross ton, f.o.b. Pittsburgh district furnace:	
Basic	\$14.00
No. 2 foundry	15.00
No. 3 foundry	14.50
Malleable	15.00
Bessemer	15.00

Freight rates to points in Pittsburgh
district range from 69c. to \$1.26.

CHICAGO

Per gross ton at Chicago furnace:	
N'th'n No. 2 fdy.	\$15.50
N'th'n No. 1 fdy	16.00
Malleable, not over 2.26 sil.	15.50
High phosphorus	15.50
Lake Superior charcoal, sil. 1.50, by rail	23.17
Southern No. 2 fdy.	16.14
Low phosph., sil. 1 to 2, Copper free	25.00
Silvery, sil. 8 per cent	23.67
Bess. ferrosil'ns, 15 per cent	28.92

Prices are delivered consumers' yards
except on Northern foundry, high phosphorus
and malleable, which are f.o.b. local furnaces, not including a switching
charge.

ST. LOUIS

Per gross ton at St. Louis:	
No. 2 fdy, sil. 1.75 to 2.25, f.o.b. Granite City,	\$17.50
III	17.50
Malleable, f.o.b. Granite City	17.50
Northern No. 2 fdy, del'd	\$17.80 to 18.30
St. Louis	18.00
Southern No. 2 fdy, del'd	14.50
Northern malleable, del'd	17.80 to 18.30
Northern basic, del'd	17.80 to 18.30

Freight rates 83c. (average) Granite
City to St. Louis; \$2.90 from Chicago;
\$4.56 from Birmingham.

NEW YORK

Per gross ton, delivered New York district:	
Ruffalo, No. 2, del'd east	\$17.41 to \$17.66
N. J.	21.00
East Pa. No. 2 fdy	14.02
East Pa. No. 2X fdy	14.52

Freight rates: \$1.52 to \$2.63 from
eastern Pennsylvania.

* Prices delivered to New Jersey cities
having rate of \$3.41 a ton from Buffalo.

BUFFALO

Per gross ton, f.o.b. furnace:	
No. 2 fdy	\$16.00
No. 2X fdy	16.50
No. 1 fdy	17.50
Malleable, sil. up to 2.25	16.50
Basic	15.50
Lake Superior charcoal, del'd	23.41

Freight rates: \$2.02 from Trenton and
Jackson, Ohio; \$3.82 from Birmingham.

CLEVELAND

Per gross ton at Cleveland furnace:	
Ala. fdy, sil. 1.75 to 2.25	\$13.82
Ala. fdy, sil. 2.25 to 2.75	14.32
Tenn. fdy, sil. 1.75 to 2.25	13.82
N'th'n No. 2 foundry	\$17.01 to 17.50
S'th'n Ohio silvery, 8 per cent	21.02

Freight rates: \$2.02 from Ironon and
Southern foundry and silvery iron.

Freight rates: 68c. average local switch-
ing charge; \$3.12 from Jackson, Ohio;

\$6.14 from Birmingham.

PHILADELPHIA

Per gross ton at Philadelphia:	
East. Pa. No. 2	\$13.34 to \$13.84
East. Pa. No. 2X	13.84 to 14.34
East. Pa. No. IX	14.34 to 14.44
Basic (del'd east, Pa.)	13.50 to 14.00
Malleable	14.74 to 18.04
Stand. low phosph. (f.o.b. east. Pa. furnace)	20.00 to 21.00
Con. b'r'g low phosph. (f.o.b. furnace)	20.00 to 21.00
Va. No. 2	21.79
Va. No. 2X	22.29

Prices, except as specified otherwise,
are del'd Philadelphia. Freight rates:
Rte. to \$1.78 from eastern Pennsylvania
furnaces; \$4.67 from Virginia furnaces.

BIRMINGHAM

Per gross ton, f.o.b. Birmingham dist.

furnace:

No. 2 fdy, 1.75 to 2.25 sil.	\$11.00
No. 2 soft, 2.25 to 2.75 sil.	11.50
Basic	11.00

Freight rates to Pittsburgh or Cleveland
district, \$1.89.

BOSTON

Dealer's buying prices per gross ton:

No. 1 heavy melting steel

PLANT EXPANSION AND EQUIPMENT BUYING

◀ NORTH ATLANTIC ▶

Ray-O-Television Mfg. Co., Long Island City, formerly known as Ray-O-Vision Corp. of America, manufacturer of radio and television equipment, has leased building at 47-01 Thirty-fifth Street, 15,000 sq. ft. floor space, for initial production of 1000 television sets a day, including parts manufacture and assembling.

Savoia Macaroni Mfg. Co., 1585-39 Sixty-third Street, Brooklyn, plans rebuilding part of four-story plant destroyed by fire, Jan. 23. Loss about \$25,000 with equipment.

Mexican Petroleum Corp., 122 East Forty-second Street, New York, plans addition to bulk oil storage and distributing plant at Carteret, N. J., including battery of 10 steel tanks, pipe lines, loading racks, pumping plant and other structures. Cost about \$40,000. A. M. McKeon is company engineer.

Browne Conveying Co., Inc., New York, has been organized by William A. Browne, 3353 Oliville Avenue, Bronx, and Simon B. Kopp, 2928 West Twenty-fourth Street, Brooklyn, to manufacture conveying machinery, bins, hoppers, chutes and kindred handling equipment.

J. K. Welding Co., Inc., 188 Centre Street, New York, operating general welding works, has taken over property at 43-19 Thirty-seventh Street, Long Island City, 10,000 sq. ft. floor space, for expansion. First noted plant will be maintained as heretofore.

Balden Point Yacht Yard, Inc., City Island, New York, recently organized by Harvey E. Hauptner and associates, has taken over shipyard of B. F. Wood, Inc., foot of Marine Street, for new boat-building and repair plant. Interests formerly identified with Kanno Boat Builders, Inc., 435 City Island Avenue, City Island, will be connected with new organization.

William H. Kemp Co., 165 Spring Street, New York, manufacturer of gold leaf and kindred precious metal goods, has leased space in building at 350 Hudson Street for new plant.

Brooklyn Edison Co., 380 Pearl Street, Brooklyn, has authorized extensions in power lines in Coney Island district, including underground installation. Cost about \$750,000 with equipment.

Otis Elevator Co., Eleventh Avenue and Twenty-sixth Street, New York, has secured contracts for elevator units and operating mechanisms for new building for United States Custom House and Appraisers Stores, Philadelphia, totaling \$228,000. Work will be carried out at plants at Yonkers, N. Y., and Harrison, N. J.

Blackburn-Smith Mfg. Co., Inc., New York, has been organized to manufacture boilers, filters, pumping machinery parts, etc., and will succeed to company of same name at 61 Broadway.

M-tor Stoker Corp., 290 Hudson Street, New York, manufacturer of automatic coal burners for residences, parts, etc., has been acquired by new interests, headed by Walter Barnum and associates, who will increase capital and carry out expansion.

City Council, Pelham, N. Y., plans installation of pumping machinery and other mechanical equipment in connection with new municipal waterworks and system. Cost about \$175,000 with equipment, pipe lines, etc.

Superintendent of Lighthouses, St. George, Staten Island, N. Y., asks bids until Feb. 14 for reconditioning Lightship No 87, including installation of machinery fuel oil tanks, piping, etc.

Prospect Tank Installation Co., affiliated with Prospect Boiler Co., Ward Street, New Brunswick, N. J., has leased one-story building, 100 x 150 ft., at 174-84 Clifford Street, Newark, for new factory branch and distributing plant for oil tanks and kindred equipment.

Public Service Electric & Gas Co., Terminal Building, Newark, plans rebuilding portion of electric generating station at Burlington, N. J., destroyed by fire, Jan. 23. Loss about \$200,000 with equipment.

New Standard Aircraft, Inc., Paterson, N. J., has been organized to manufacture airplanes and parts, and will take over New Standard Aircraft Corp., 230 East Sixteenth Street. Paul Martin is incorporator of new company.

Peter Wendel & Sons, Inc., 171 Badger Avenue, Newark, manufacturer of commercial wagons, parts, trucks, etc., has rejected bids recently received for one and one-half story addition, 100 x 300 ft. Proposed to ask new bids later. Cost over \$50,000 with equipment.

Commanding Officer, Picatinny Arsenal, near Dover, N. J., asks bids until Feb. 6 for forgings, including upper time train rings, gear rings, fuse forgings, etc. (Circular 125.)

Signal Supply Officer, Army Base, Brooklyn, asks bids until Feb. 6 for 120,040 ft. wire (Circular 51), 385 resistors (Circular 53); until Feb. 14, transmitting tubes (Circular 54).

Ford Motor Co., Detroit, is arranging for increased production at branch assembling plant at Chester, Pa. Present working force of 1500 men will be more than doubled and full-timed basis adopted.

American Commercial Alcohol Corp., Delaware Avenue and Tasker Street, Philadelphia, let general contract to S. H. Levin, 1619 Sansom Street, for one-story tank house. Cost about \$25,000 with equipment.

Commanding Officer, Frankford Arsenal, Philadelphia, asks bids until Feb. 6 for 55 electric motors (Circular 269); until Feb. 20, 46 electric generators (Circular 268).

Metalloys, Inc., Williamsport, Pa., recently organized, has taken over part of former local factory of United States Rubber Co. for manufacture of metal and metal alloy products.

State Highway Department, Dover, Del., asks bids until Feb. 14 for catch basin castings, cable guard rail, end post attachments, pipe, etc.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Feb. 7 for one electric dynamometer (Schedule 9523) for Philadelphia navy yard.

Schutte Pulverizer Corp., Buffalo, has been organized by Herman D. Schutte, 621 Eggert Road, and associates, to manufacture pulverizing machinery and parts.

Catholic Union & Times, 85 Erie Street, Buffalo, plans rebuilding part of printing and publishing plant recently destroyed by fire. Loss about \$70,000 with equipment.

Commanding Officer, Watervliet Arsenal, Watervliet, N. Y., asks bids until Feb. 7 for alloy steel forgings for 3-in. A. A. guns (Circular 20).

Texas Corp., 135 East Forty-second Street, New York, has acquired a substantial interest in Goodyear-Wende Oil Corp., 26 Lansing Street, Buffalo, oil and gasoline distributor, and plans expansion, including new bulk oil storage and distributing plants in neighboring districts. Hamilton H. Wende will continue as president.

◀ CENTRAL DISTRICT ▶

Pennsylvania Railroad Co., Pennsylvania Terminal, Pittsburgh, is considering rebuilding steam-operated electric power plant at Johnstown, Pa., recently destroyed by fire. Loss about \$50,000 with equipment.

Treadwell Construction Co., Midland, Pa., and its subsidiary, Midland Barge Works, Midland, are advancing production schedule at steel barge-building plant, recalling about 200 men. Company has recently secured Government contract for new suction dredge boat at \$131,000.

Molybdenum Corp. of America, Grant Building, Pittsburgh, has taken options for purchase of properties of International Vanadium Corp., Salt Lake City, Utah, and Vanadium Alloys Corp., Denver, and will consolidate. Expansion and development program will be carried out. Purchasing company is arranging for increase in capital from \$500,000 to \$650,000 for work.

Industrial Rayon Corp., West Ninety-eighth Street and Walford Avenue, Cleveland, manufacturer of cellulose rayon products, has awarded general contract to George A. Rutherford & Co., 2725 Prospect Avenue, for two wing additions. Cost about \$100,000 with machinery. Christian, Schwarzenberg & Gaede Co., 1836 Euclid Avenue, is architect and engineer.

Plated Wares, Inc., East Cleveland, care of William J. Dawley, 1728 Standard Bank Building, Cleveland, representative, has been organized by E. F. Haflinger and F. R. Kissling, East Cleveland, to manufacture plated metal ware.

Hollenkamp Products Co., 816 Brown Street, Dayton, Ohio, plans extensions and improvements in brewing plant, with installation of bottling machinery and other equipment. Cost about \$50,000 with machinery. Theodore Hollenkamp is president.

Seinheimer Paper Co., 1240 York Street, Cincinnati, manufacturer of paper bags and containers, has leased about 12,000 sq. ft. in building at Thomson Avenue and Manly Street, Long Island City, N. Y., for new branch plant for Eastern trade.

Contracting Officer, Material Division, Wright Field, Dayton, Ohio, asks bids until Feb. 6 for one panel and framework assembly, and one power and control panel and cabinet (Circular 349); until Feb. 7, 800 conduit clamps, 800 conduit unions and 1600 conduit clamp nuts (Circular 342); until Feb. 8, 4000 lb. ingot aluminum (Circular 339); until Feb. 14, 63 universal exposure meters (Circular 351), 208 keyseat cutters and 63 milling cutters (Circular 344); until Feb. 13, one motor-driven sheet metal cutter (Circular 348); until Feb. 15, 148 landing gear wheel assemblies, 148 stub axle assemblies and 148 brake assemblies, (Circular 337); 401 bolt and bracket gun trunnion assemblies and 693 gun mounting post assemblies (Circular 340).

Sound Systems, Inc., 7113 Euclid Avenue, Cleveland, a subsidiary of Station WHK Broadcasting Station, Terminal Tower Building, is beginning manufacture of new line of amplifiers and allied radio equipment, and will develop increased production. Company recently secured contract for amplifiers totaling about \$450,000.

Aero Safety Control Co., Cleveland, care of Geddy F. Penland, 1037 Schofield Building, representative, has been organized by George A. Bouquet and E. J. Curtis, Cleveland, to manufacture aircraft equipment and parts.

Weil Packing Co., 1700 Oakley Street, Evansville, Ind., meat packer, is planning new one-story plant. Cost close to \$45,000 with equipment.

Berghoff Brewing Co., Fort Wayne, Ind. H. J. Bowerfind, vice-president, is planning expansion and improvements, with installation of additional equipment. Cost about \$125,000 with machinery. Substantial interest in this company was acquired recently by F. A. Brewer & Co., 208 South LaSalle Street, Chicago, investment securities.

Williams Brothers & Miller, Inc., East Chicago, Ind., has been organized by D. W. and F. W. Williams, and W. L. Miller, East Chicago, to manufacture heating equipment, stokers, oil burners and kindred products.

B. F. Goodrich Rubber Co., Akron, Ohio, has awarded general contract to William P. Jungclaus Co., 825 Massachusetts Avenue, Indianapolis, for one-story factory branch, storage and distributing plant, 20,000 sq. ft. floor space, at Indianapolis. Cost about \$50,000 with equipment. D. A. Bohlen & Son, Majestic Building, Indianapolis, are associate architects.

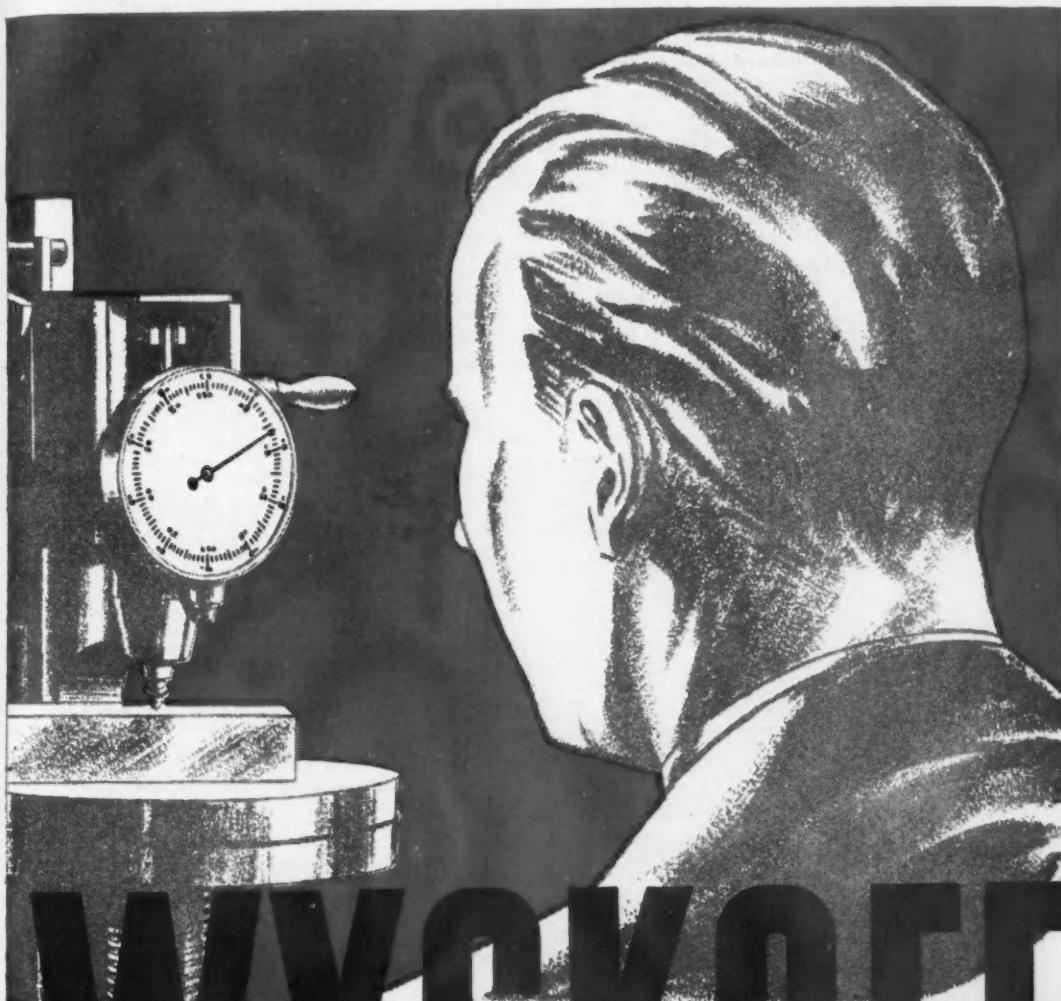
Kalamazoo Brewing Co., Kalamazoo, Mich., is planning expansion and improvements, including remodeling of present warehouse for a new brewing unit, with installation of bottling, conveying and other equipment. Cost about \$70,000 with machinery.

Mueller Brass Co., Port Huron, Mich., manufacturer of general brass goods, fittings, etc., has acquired Sky Specialties Corp., 3651 Hart Street, Detroit, manufacturer of aircraft engine equipment, engine starters, etc., and will operate as an affiliated interest.

Central Bolt & Nut Co., 1155 Bellevue Avenue, Detroit, has been organized by James I. Ford, 288 Marlborough Avenue, and associates, to manufacture bolts, nuts, studs, automobile hardware and kindred products.

Allen Corp., 1040 Fourteenth Street, Detroit, manufacturer of ventilating equipment and appliances, has developed a new electro-wind turbine ventilator, combining forces of wind and electricity, and plans extensive commercial production including parts and assembling.

Corduroy Tire & Rubber Co., Grand Rapids, Mich., manufacturer of automobile tires and



WYCKOFF

DEPENDABLE COLD DRAWN STEELS

THE RAPID DUPLICATION OF MACHINED STEEL PARTS AT LOWEST COST CONTINUES TO DEPEND UPON THAT PERFECTION AND PRECISION WHICH ONLY COLD DRAWN STEELS CAN GIVE.

That is why manufacturers, users and operators of automatic screw machines always specify **cold drawn steels** to attain the full production and profit advantages from their equipment.

In this period of exceptionally close margins,—you cannot afford to take chances with an inferior product. Only through the use of **cold drawn steel bars** can you obtain the increased physical characteristics, exactness to size, straightness and guaranteed machining performance so essential to the maintenance of present-day production costs.

The WYCKOFF organization will welcome an opportunity of cooperating with you,—any time.

Wyckoff Drawn Steel Company, Pittsburgh



GENERAL OFFICES: FRICK BUILDING, PITTSBURGH, PA.

CHICAGO OFFICES: 3200 SOUTH KEDZIE AVE., CHICAGO, ILL.

MILLS, PITTSBURGH, PA., CHICAGO, ILL.

tubes, is planning one-story addition. Cost over \$25,000 with equipment.

Highway Safety Appliance Corp., 1903 First National Bank Building, Detroit, has been organized by W. G. Coleman, 21719 Grand River Avenue, and associates, capital \$100,000, to manufacture highway safety signal devices and kindred safety equipment.

Ford Motor Co., Dearborn, Mich., is resuming production for new model car at branch plant at Windsor, Ont., operated by Ford Motor Co. of Canada, Ltd., reinstating about 1000 men.

Stearns-Stafford, Inc., Lawton, Mich., which has been organized to take over Stearns-Stafford division of George P. Nichols & Brother, Inc., will continue manufacture of staggered roller bearings at Lawton, concentrating on manufacture of roller bearings for railway equipment and on heavy-duty bearings for industrial purposes. O. F. Packer, general manager of Lawton plant since 1923, has been appointed president and general manager of new company.

◀ SOUTH ATLANTIC ▶

Chemical Warfare Service, Edgewood Arsenal, Md., asks bids until Feb. 7 for one vacuum pump (Circular 37), one mechanical exhaust fan with electric motor (Circular 38).

City Council, Hagerstown, Md., had plans for a municipal incinerator plant, with power station, conveying, unloading and other mechanical equipment. Cost over \$70,000 with machinery. Fuller & McClintock, 170 Broadway, New York, are consulting engineers.

Appalachian Electric Power Co., Roanoke, Va., has purchased power dam at Lynchburg, Va., from Chesapeake & Ohio Railroad Co. and plans erection of new hydroelectric generating plant on site. Plant will be tied in with Reuseens power plant of company in same district. Cost over \$500,000 with transmission lines, switching stations and other structures.

General Purchasing Officer, Panama Canal, Washington, asks bids until Feb. 6 for galvanized steel guy wire, phosphor bronze wire, 10,000 ft. bare antenna wire, 200 resistance units, brass machine bolts, stove bolts, sheathing nails, steel snatch blocks, two wheel and camber gage aligners, one valve refacer machine, copper tubing, sheet aluminum, safety chain, 10 gate valves and other mechanical equipment (Schedule 2833); until Feb. 13, three Diesel engines, each 125 hp., one 30-hp. Diesel engine, three 75-kw. generators, one 21½-kw. generator, one motor-generator set, and one switchboard (Schedule 2832).

Wilson Finishing Mills, Burlington, N. C., plans erection of steam power plant in connection with three-story addition to textile mill. Cost over \$65,000. H. V. Biberstein, Charlotte, N. C., is architect and engineer.

Bureau of Yards and Docks, Navy Department, Washington, asks bids until Feb. 15 for piping, conduits and other work for extension of foundry at Norfolk, Va., Navy Yard (Specification 7105), air-conditioning system for fleet air base, Pearl Harbor, T. H. (Specification 7165).

Town Council, Fincastle, Va., is considering installation of pumping machinery and other equipment for new municipal waterworks. Cost over \$40,000 with pipe lines, etc.

Virginia Airship Co., Richmond, Va., has been organized by Richard M. Dunn, Westmoreland Place, and associates, capital \$1,250,000, to manufacture airplanes and parts. F. Harrison Lee, Richmond, is interested in new company.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Feb. 7 for one motor-driven, 42-in. knife grinder (Schedule 9520); until Feb. 14, two motor-driven horizontal boring, drilling and milling machines, and equipment (Schedule 9557), 11,760 lb. bar brass (Schedule 9545) for Norfolk, Va., Navy Yard; until Feb. 7, portable fire extinguishers (Schedule 9544), power shovel and attachments (Schedule 9433); until Feb. 14, steel boiler tubes (Schedule 9506), 10 exhaust heated evaporator boilers and spare parts (Schedule 9505) for Eastern and Western yards; four floor-type arbor presses (Schedule 9508) for Brooklyn, Philadelphia, Mare Island and Puget Sound yards; 85 electric refrigerating units and spare parts (Schedule 9518) for Sewalls Point, Va., and Mare Island yards; 12 air compressors (Schedule 9537) for Boston, Brooklyn, Philadelphia and Puget Sound yards; until Feb. 7, 20 air pressure gages (Schedule 9509) for Philadelphia and Norfolk yards; 10 lubricating oil coolers and 370 spare tubes (Schedule 9507) for Boston, Brooklyn and Philadelphia yards.

◀ NEW ENGLAND ▶

Colonial Beacon Oil Co., 20 Providence Street, Boston, has acquired site near Mohawk River, Schenectady, N. Y., for new bulk oil storage and distributing plant, to include battery of steel tanks and pumping station. Cost about \$80,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Feb. 7 for one motor-driven brass-finishing turret lathe and equipment (Schedule 9519); until Feb. 14, one motor-driven wood saw, tilting arbor (Schedule 9547) for Portsmouth, N. H., Navy Yard.

Durr-able Oil Burner Corp., Hartford, Conn., has been organized, capital \$50,000, by Asgar Nielsen and E. D. Wilson, Wethersfield, Conn., and C. M. Durr, Deep River, Conn., to manufacture oil burners and oil-burning equipment.

Connecticut Broadcasting Co., Danbury, Conn., Donald S. Bean, head, is planning new broadcasting station, with steel towers, power station and other equipment.

Town Board of Education, Somers, Conn., will install vocational training department in new two-story and basement grade school. Bids will be asked on general contract in February. Cost over \$125,000. Ebbets & Frid, Hartford, Conn., are architects.

P. & S. Polishing & Plating Co., Inc., Providence, R. I., has been organized by Max A. Peisach, 35 Robinson Street, and associates, to operate a metal plating and polishing works.

Milton Water Commission, Milton, Mass., Edward L. Hurd, chairman, is planning installation of steel tanks in the Blue Hills Reservation district for increased water supply, with new pipe lines and distributing facilities.

◀ MIDDLE WEST ▶

Climax Radio Corp., Chicago, recently organized, has leased space in building at 1325 South Michigan Avenue, for manufacture of radio equipment and parts. J. L. Gaber is president.

Wilson & Bennett Mfg. Co., 6532 South Menard Avenue, Clearing, Chicago, manufacturer of steel barrels, drums, etc., has leased building at New Orleans for expansion at branch plant there, doubling present capacity. R. E. Hurd is manager at New Orleans.

American Expansion Bolt & Mfg. Co., Chicago, has been organized by J. Warren Iselt and Henry B. Freeman, to manufacture expansion bolts, hardware products, etc. Company will take over American Expansion Bolt Co., 108-28 North Jefferson Street.

Perfection Oil Co., Dubuque, Iowa, now being organized by J. P. Mettel, head of Mettel Land & Security Co., 1220 Iowa Street, and associates, is planning new bulk oil storage and distributing plant in Eagle Point district, including steel tanks, pumping station, unloading facilities and other equipment. Cost about \$45,000 with equipment.

Signal Corps Procurement District, 1819 West Pershing Road, Chicago, asks bids until Feb. 7 for 48 generators and other equipment (Circular 23).

Common Council, Hamburg, Iowa, is considering erection of a municipal electric light and power plant. Special election will be called soon to approve bond issue of \$150,000 for project.

Woodstock Typewriter Co., Woodstock, Ill., manufacturer of typewriters and parts, is running on five-day week basis with close to normal working force. Company has recently secured order for 1587 typewriters from Board of Education, New York.

City Council, Aberdeen, S. D., has rejected bids recently received for prime movers and other equipment, traveling crane, etc., for proposed municipal electric light and power plant, and contemplates call for new bids soon. Cost about \$850,000 with machinery. J. W. Henry, First National Bank Building, Aberdeen, is architect; Bemis Co., 105 West Adams Street, Chicago, is consulting engineer.

Quartermaster, Fort Francis E. Warren, Wyo., asks bids until Feb. 13 for extension in water distributing system, including pipe lines, hydrants, etc. (Circular 2).

Johnsen Piston Ring Co., Wausau, Wis., has been incorporated with \$25,000 capital stock to manufacture piston rings and similar automotive parts for replacement trade. Manufacturing arrangements are being completed. Principals are S. L. Johnsen, Erving Walker and Elizabeth Johnsen.

Northern Pacific Railroad has started work on \$60,000 repair job on its ore dock in East End, Superior, Wis.

Hannum Mfg. Co., 634 Keefe Avenue, Milwaukee, has changed its corporate title to Lavine Gear Co., under which name it was originally incorporated in 1910. Later George H. Hannum of Detroit acquired control. He retired several years ago and Herman A. Uihlein resumed control and management. Company specializes in general line of automotive steering gear assemblies.

◀ SOUTH CENTRAL ▶

American Tung Oil Products Corp., 30 Bay Street, St. George, Staten Island, N. Y., is considering new oil processing plant near Carriere, Miss., where company has about 5000 acres of tung oil trees. Cost about \$50,000 with machinery. Thomas H. Hawkes is president.

Louisiana Lime Products Co., Easton, near Oakdale, La., has work under way on first unit of new hydrate lime plant. Cost about \$35,000 with equipment. It is proposed to erect additional units later. J. H. McDaniel is superintendent. Company was organized recently by Warren G. Gray, Alexandria, La., and associates.

Emory Pipe & Foundry Co., Inc., Anniston, Ala., will soon begin erection of one-story foundry to replace unit destroyed by fire several months ago. Orders for equipment will be placed at once. Cost close to \$50,000 with equipment.

Jefferson Lake Oil Co., Lake Peigneur, La., plans addition to power plant at sulphur mining properties, with equipment for capacity of about 3000 hp.

◀ SOUTHWEST ▶

City Council, Great Bend, Kan., has engaged E. T. Archer & Co., New England Building, Kansas City, Mo., consulting engineers, to prepare plans for municipal electric light and power plant, and distributing system. Cost about \$300,000 with equipment.

Fuel Gas Mixer Corp., St. Louis, has been organized by Harry Schwartz, 916 Clarendon Place, and associates, to manufacture gas-burning equipment and kindred fuel apparatus.

C. C. Yeager, Gladewater, Tex., is at head of project to build new oil refinery near Texarkana, Ark., where about 10 acres is being secured in McKinney district, approximately 15 miles from city limits. Plant will have capacity for handling about 1000-bbl. crude oil a day, and will include storage and distributing facilities. Cost over \$85,000 with equipment.

Automatic Door Co., St. Louis, has been organized by B. F. Weinberger, Wainwright Building, and associates, to manufacture special automatic door equipment.

Frigid Food Products, Inc., East Ferry Street and Grand Trunk Railroad, Detroit, has leased one-story addition, 50 x 110 ft., to be erected at plant of Tulsa Cold Storage Co., Tulsa, Okla., for new electric-operated refrigerating plant. Cost over \$35,000 with equipment.

Bell Oil & Gas Co., Kennedy Building, Tulsa, Okla., has plans by Rex Young, company engineer, for extensions and improvements in oil refinery at Grandfield, Okla. Albert Finsiton will be in charge of equipment purchases. Installation will include machinery for gasoline production, two refractinating towers, pressure vessels, oil skimming and other equipment. Cost about \$100,000 complete.

Adamson Coal Co., Yale Avenue and Eleventh Street, Tulsa, Okla., plans rebuilding part of coal tipple, recently damaged by fire. Henry Adamson is president.

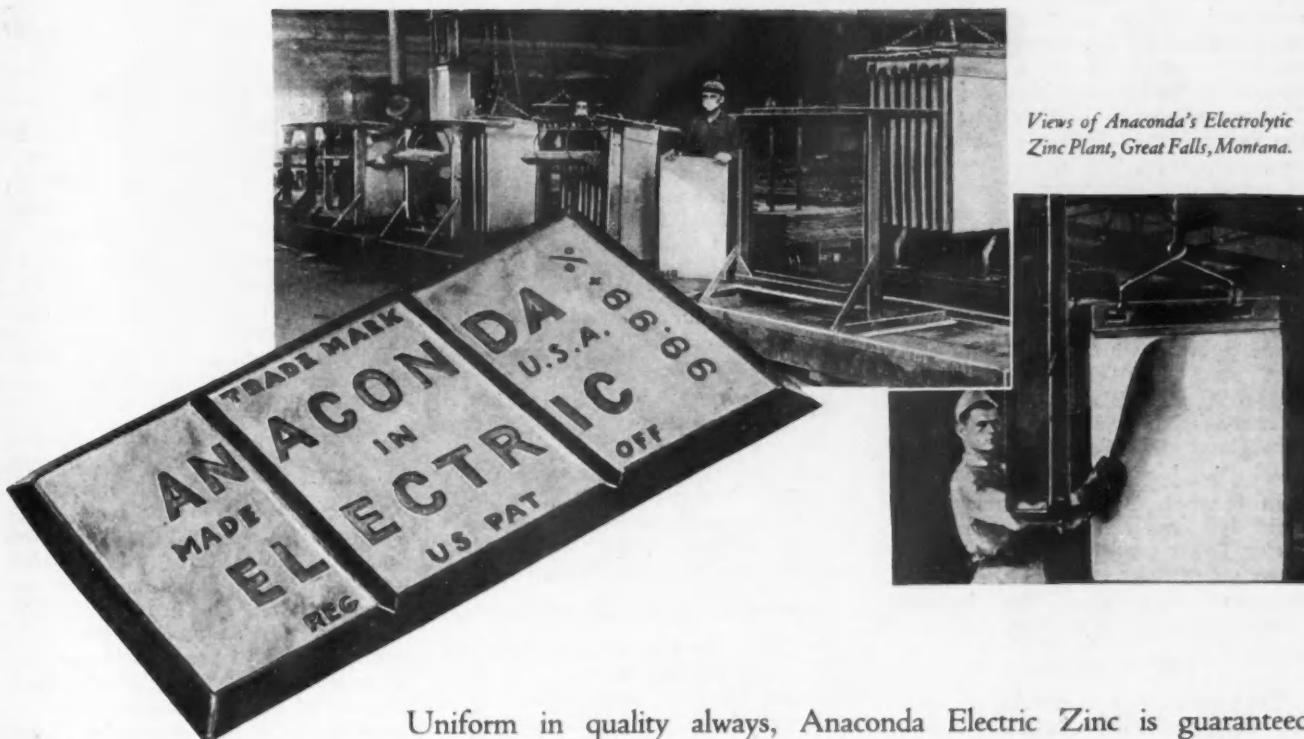
Guillory Refining Co., Kilgore, Tex., is arranging early rebuilding of part of oil refinery recently damaged by fire. Loss over \$35,000 including equipment. W. L. Williams is manager.

◀ PACIFIC COAST ▶

Sierra Brewing Corp., 639 South Spring Street, Los Angeles, Charles S. Forve, manager, has acquired former plant of Mathie Brewing Co., North Main Street, and will remodel for new works. New machinery will be installed, to cost about \$150,000 of total of \$250,000 scheduled for program.

Bureau of Yards and Docks, Navy Department, Washington, asks bids until March 8 for new steel floating dock at naval operating base, San Diego, 393½ ft. long, 60 ft. beam, with closed bow and hinged gate at stern, including oil engine-generator, pumping machinery, piping, light and power system, and other accessory equipment (Specification 6352).

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Views of Anaconda's Electrolytic Zinc Plant, Great Falls, Montana.

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What the Machine Has Done to Us

(Continued from Page 191)

ures, including that of the Westinghouse company and of ten New York banks within a single week. There occurred a violent "tight money" panic in the fall, marked by deposit of \$25,000,000 of Federal funds in New York banks. Clearing house certificates were in use and moratoria declared, with numerous bank suspensions throughout the country. The acute panic stage had passed by the end of the year.

During 1908, railroad "baiting" was continued, but the heavy fine against the Standard Oil Co. was set aside by the courts and there was a good bond market by the latter half of the year. Taft was elected to the Presidency and the Payne-Aldrich high tariff bill was enacted in 1909. The aggregate value of crops continued high. Anti-trust suits and strikes continued to harass business into 1911.

In 1911, a suit to dissolve the United States Steel Corp. was instituted.

The year 1912 saw the three-cornered fight in which the Republican vote was split between Taft and Roosevelt and Wilson was elected. "Trust-busting" activities continued throughout this and the following year.

In October, 1913, the Underwood tariff bill was enacted and the Supreme Court sustained the power of the State utilities commissions in the Minnesota rate cases. The Federal Reserve Act was signed Dec. 23, 1913.

The World War

The year 1914 is memorable as having marked the outbreak of the World War, when Austria declared war on Serbia, July 28. All was confusion as country after country was drawn into the conflict, panic ensued and the New York Stock Exchange was closed July 31 to Dec. 12. The European combatants withdrew their gold balances from this country, but war orders began to stimulate business while aggregate crop values were high. As war orders began to mount and industry to hum, court decisions became more favorable to railroads and other corporations.

In 1915, gold began to flow back, followed by an Anglo-French and other loans for the purchase of munitions. High crop prices with large yields resulted in large agricultural purchasing power and industry was swinging into its war-time stride. Wages and prices rose. With the expansion of activity came credit expansion, the Anglo-French and other loans of 1915 being followed by further Anglo-French loans in 1916 and later in the same year a Russian loan. Aggregate value of farm crops had been reaching new record highs year after year when the Federal Farm Loan Act was enacted in July, 1916. Railroad train-

men submitted their 8-hr. day demands to arbitration as the railroads headed into financial difficulties.

Another memorable year was 1917. We entered the European conflict April 6. Credit expansion continued as the British War Loan was followed by the First Liberty Loan and the Second Liberty Loan. With our own entry as combatants came food control and price fixing of wheat, coal, sugar, coffee, copper, steel and so forth. The War Industries Board was organized, a director of transportation appointed and the Shipping Board established. Finally the United States Government took over the railroads and established new and higher wage scales.

In 1918 we had rationing of coal, electricity, foods and so on. Then came the Third Liberty Loan and the War Finance Corporation. Treasury Certificates of Indebtedness were issued and more foreign credits extended. Then came the Fourth Liberty Loan. The Armistice was signed Nov. 11.

The year of 1919 was in all respects most abnormal. Every activity of the country was pitched to a high key. Labor troubles were numerous and included the Boston police strike. Credit was further extended by the sale of the Victory Loan bonds. Wages were increased and crop prices high.

Commodity Prices Reach Peak

In 1920, the wholesale commodity price index reached its peak, but before the year was over retail prices were drastically cut and commodity prices began a collapse. In analyzing the events of this year it is important to remember the highly excitable condition of the public mind, still keyed to the war tempo. It is important also to remember that the rapidly rising commodity prices throughout the war and immediately following created an eagerness to accumulate inventories so as to benefit by the rise in value. Contractors for future delivery were compelled to cover their requirements far in advance lest they be unable to get goods and materials at the prices figured in the contracts. The commodity price break of that year was therefore conditioned by no ordinary lag of consumption behind current productive capacity but was really a commodity panic unnaturally accelerated by the threat of enormous accumulated stocks of goods hanging over the market.

The year 1921 brought scattered wage rate reductions and further price declines.

In May, 1922, the Immigration Restriction Act was passed. The year was marked by widespread strikes especially on the railroads and in the coal mines. Most of the major strikes

were settled by the end of the year. Large issues of securities were sold.

In 1923, prices and wages rose.

In 1924, Coolidge was elected. Heavy financing was floated. Higher crop prices raised farmer purchasing power and thus stimulated industry.

The year 1925 saw \$2 wheat. England returned to the gold standard. A large volume of new securities was sold. This was also the year of the Florida real estate inflation and showed a marked increase in installment selling.

In 1926, conditions were somewhat unsettled. French and Belgian francs and Italian lire collapsed. Large foreign security issues were sold in this country.

Security Issues Increase

In 1927, building was active in the spring and there was a sharp rise in grain prices on unfavorable crop reports. Large domestic and foreign security issues were again financed.

In 1928, mail order sales showed an increase, reflecting farmer purchasing power. Steel orders also were good. Extensive foreign and domestic bond issues were sold. The Farm Board announced advances on wheat at \$1.25 per bushel. Hoover was elected.

In 1929, wage rates were increased and the Federal Reserve Board, in February, issued a warning against further expansion of speculative credit. The sale of foreign bond issues in the United States was retarded, but there were large issues of domestic stocks. The Farm Relief Bill was enacted. Automobile production for the first half year was at a record high level. There were enormous offerings of investment trust securities between June and September. Stock prices collapsed in September, demoralizing the market and resulting in a drastic contraction of industry.

In 1930, in spite of the drastic contraction and many sharp declines in specific commodity prices, there persisted a widespread feeling that only courage was needed to restore "prosperity." Industrial stock prices had regained, at one point, half their loss. There was much discussion of our passage from the position of a debtor nation to that of a creditor nation. Many felt that, with that transition, business could be maintained on a high level only by financing the operations of our debtors. In spite of the warning of the drastic market decline in the preceding fall, large issues of new foreign and domestic securities were sold in the spring of 1930 and a German loan of \$98,250,000 was placed in this country, followed by an Austrian loan. The rise of Hitlerism in Germany, however, unsettled confidence and foreign bond prices collapsed. Renewed liquidation followed, resulting in the failures of several important New York Stock Exchange houses and, subsequently, outbreaks of bank failures in various parts of

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the country affecting both large metropolitan banks and groups of "country banks."

The further declines in stocks, bonds and in commodity prices, in industrial and trade activity, and in employment and wage distributions are of too recent memory to require retelling.

This brief historical summary, partly quoted, partly abstracted and partly expanded from Warren M. Persons' arrangement of information from the supplement to the Review of Economic Statistics for July, 1920, and from other sources, aims only to select certain events which would appear to have a direct bearing on the operations of the manufacturing industries of the United States and to have influenced the phases studied, in one way or another.

Repeating Economic Sequences

The intention here is not primarily to record a succession of historical events (on which there are ample data available in histories) but to collect certain typical classes of events and to show how, time after time, the whole economic structure of the nation has been shaken to its very foundations and to show how closely certain sequences have been repeated. It will be amazing to note, as the various phases are developed, how this vast and complex structure has figuratively been turned topsy-turvy time after time and yet seems to have held through it all very closely to certain apparently basic trends.

The disturbances, of course, are of greater extent as they occur in a structure of greater magnitude. By virtue of this growing magnitude in the body in which these disturbances occur, they may have been more nearly proportional than many have thought.

The apparent exception lies in the almost continuous expansion of credit year after year throughout the 15-year period from 1914 to 1929. It might have been expected that no previous period would show credit expansion on so large a scale. Continued and almost uninterrupted flotations of Government bond issues, and of private loans and stock issues, for so long a period may be disproportional in point of repetition. This may be one new factor in the situation.

As so ably developed by Wesley C. Mitchell in his "Business Cycles, the Problem and its Setting," the modern business cycle is, in all of its phases, inextricably tied up with our modern business organization in which the making and spending of money incomes is the dominant factor.

But the term "modern," in this connection, seems to have a scope much broader than has been attached to it by many. We may now, for the first time, be confronted with a "paradox of plenty" of some kinds of things while we see vast numbers of our people unable to secure those things they

so desperately need. This may be a situation growing out of our industrial development, with respect to those particular kinds of things.

It appears, however, that long before our industrial development was conceived, when agricultural pursuits far overshadowed industrial and hand labor predominated over power applications, there may have been a "paradox of plenty" of other kinds of things, just as tragic in its consequences. Perhaps there was then a plenty of land and of raw material resources scattered over a continent and lacking the means of communication and of transportation.

In any event, our predecessors of a hundred years ago, who knew little of machines and nothing of technological unemployment, seem to have experienced the impacts of the changing phases in the business cycle with results no less severe in terms of human suffering than are the troubles which now beset us.

Perhaps the picture was set in a different frame but possibly, after all, composed of the same elements of light and shade.

Heat Treating Locomotive Castings

(Concluded from page 193)

partment. When three blows struck, as described above, failed to cause fracture at any point, the engineers decided as a matter of interest to reverse the wheel and continue the test by striking the hub on the opposite side. After two blows had been struck in this fashion and no sign of a fracture developed, it was decided to apply the full 100-ft. ton blow to one arm of the wheel. This blow failed to cause any fracture in the arm which was bent into a curve as shown at the point indicated by an arrow in Fig. 3. A very slight check was developed in the rim next to one of the supports by this last blow.

Fig. 4 shows another wheel subjected to three blows on one side of the hub which failed to develop any sort of fracture. These two illustrations, Figs. 3 and 4, show the distortion caused by the drop tests described. It will be noted that a slot had been previously cut in the rim ($\frac{1}{2}$ in. wide by 2 in. deep) to determine solidity.

Heat-treated carbon steel castings offer the designing engineer an economical solution for many of his problems which call for higher physical properties than ordinary annealed or normalized steel affords. The same improvement (and more) is of course possible with alloy steels heat treated by quenching and drawing, as compared with the same steels treated in the usual manner.

There is a greater improvement possible in steel casting properties by

quenching and drawing as compared with annealing, than there is by annealing as compared with the "as cast" condition.

Cooper-Bessemer Corp. Celebrates Centenary

The Cooper-Bessemer Corp., Mount Vernon, Ohio, one of the oldest builders in the United States of oil and gas engines, is celebrating its centenary. Two brothers, Charles and Elias Cooper, built a small iron foundry at Mount Vernon in 1833 and thereby laid the foundation for a business now valued at \$8,000,000.

The C. & G. Cooper Co. first made castings for plows, carding machines and saw mill machinery. A few years after the cupola fan with its horse-power rig was constructed the panic of 1837 threatened to wipe out the infant industrial plant, but the brothers hung on, and a little more than a decade later built the first steam locomotive manufactured west of the Alleghenies. It was delivered to the Baltimore & Ohio Railroad and was followed by others of the same type.

Recurring panics made periodic threats at the expanding company, but the Coopers issued scrip when money became scarce and the fiat was honored throughout central Ohio.

In the late 50's the Coopers designed and built the Corliss engine for distribution in the West and they shared for many decades in the popular reception of that famous old steam plant.

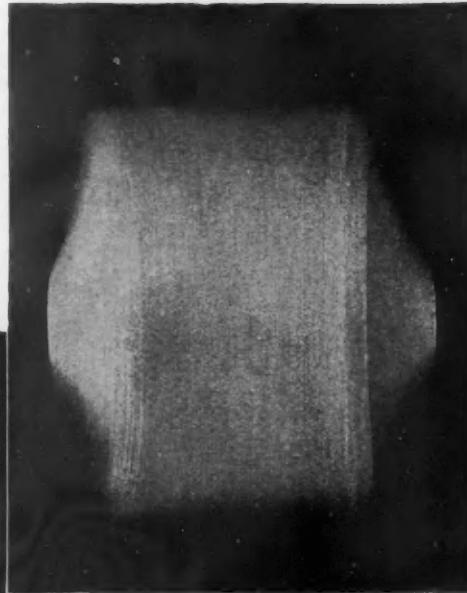
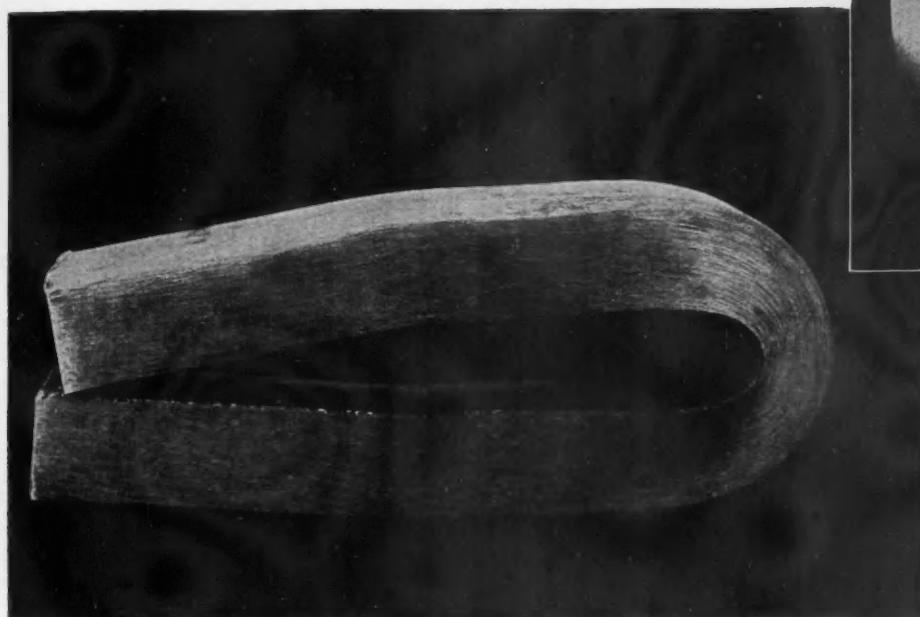
With the turn of the century, the Cooper company was widely noted as builders of high-powered steam engines and at that time it began to turn to the new natural gas and petroleum industries. Across the border, in Pennsylvania, the founders of the Bessemer Gas Engine Co. were starting to supply clutches for engines in the oil fields and the two companies grew along similar lines.

The Cooper and the Bessemer companies had so paralleled their activities by 1929 that the former made a purchase of the latter, and the present corporation was organized.

New Coal Rate Granted to Valley Interests

WASHINGTON, Jan. 28.—Authority has been given the Pittsburgh & Lake Erie and the Baltimore & Ohio railroads by the Interstate Commerce Commission to establish a proportional rate of \$1.02 a net ton on bituminous coal, ex-river, from Colona, Pa., to Canton and Massillon, Ohio, without observing the long-and-short haul provision of the interstate commerce act. The lower rates were asked by these two carriers to enable them to compete with ex-river rates maintained by the Pennsylvania from Conway, Pa., to the same destinations.

Here is an Alloy Steel you can sell AS-ROLLED— CROMANSIL



End View of Cold-Bent Plate

Note high ductility with complete freedom from cracking in this as-rolled Cromansil plate.

Cold Bend of Cromansil Plate

This one-inch boiler-plate grade of Cromansil steel in as-rolled condition was cold-bent flat on itself with 80 per cent elongation on the outside of the bend and with no fracture.

■ As-rolled or normalized Cromansil (a chromium-manganese-silicon alloy) can be cold-bent more than 180 deg. around a pin whose diameter is 1-1/4 times plate thickness. These are its physicals:

Carbon	0.20 per cent.
Plate thickness	3/4 in.
Proportional Limit (psi) .	47,500 lb. per sq. in.
Yield Point (psi)	61,800 lb. per sq. in.
Ultimate Strength (psi) .	95,000 lb. per sq. in.
Elongation in 8 in.	22 per cent.

In its as-rolled condition, Cromansil can be welded without air-hardening; and tests at Lehigh University have proved its excellence for riveting. ■ Any open-hearth operator can produce Cromansil steel without departing from usual metallurgical procedure. Its higher cost is justified by its higher

physical properties which make it suitable for saving weight in seamless tubing, ship plate, castings, structural shapes, tanks, cars, pen-stocks, staybolts, pressure and process equipment, pipe, and machine parts. Our new booklet, "Cromansil Steels," gives the complete story. Send for it now.

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Ingots Cast by New Method

(Concluded from Page 197)

oxygen. The total cost of this cutting operation at the present time, using makeshift equipment, cutting the wings singly and using an ordinary nozzle, amounts to about \$1.20 on the 1-ton ingot, and 80c. a ton on the 5-ton ingot. This can be very much reduced by the use of properly designed equipment and the cutting of the three wings simultaneously. Equipment for this is now being prepared. The surface of the cut is excellent and almost as clean as if done by a saw or parting tool. An examination of billet sections shows no trace of oxidization or overheating at the surface where the cut took place.

Satisfactory Structure

It will be said that the structure of the open side differs from the other sides. This is true insofar as the size of grain goes, but porosity does not exist. The hardening properties and the freedom from segregation of the finished material are good. Should it be desired to equalize the structure, a process may be used (U. S. patent No. 1,836,311) which by specially designed rolls, forces the structure next the cut into the center of the bar and draws the outer chilled edges together. It was once thought that this might be desirable, but further tests have shown that it is unnecessary and that it is not detrimental for the original ingot to have a larger grain structure on one side than on the other sides. Subsequent hammering and rolling break this down.

Recovery in Finished Bars

The actual recovery in finished bars from this type of ingot is shown by the following figures, which are representative of the 5-ton mold:

Ingot weight as cast . . .	10,027 lb.
Cutting loss . . .	182 lb.
Center discard . . .	1,477 lb.
Weight of wings . . .	8,397 lb.
Weight of finished steel passing the etch test	
100 per cent at both ends of the bar . . .	7,150 lb.

Probably because of incorrect mold design or practice, more discard had to be taken from the ends of the wings than should be necessary. All these discards were due to a shelly or dirty condition at or under the surface and were in no case caused by anything approaching pipe. This can be eliminated with proper design and practice, and it should be possible to obtain a piece of steel which is virtually a billet and requires no cropping other than a squaring of the ends. No trouble has been experienced recently with the inner corners of the molds, these being protected with a semi-circular strip of mild steel. The life of the molds also appears to be about the same as would be obtained from a normal square or flat mold.

Because of less shrinkage, the hot top used on a winged ingot is about one-third as costly as the bricks for a similar weight of steel cast in standard square molds. One hot-top brick is used in the winged ingot in place of three of the same size used on square molds. The saving in hot-top bricks, therefore, including purchase price, freight and handling, should be nearly sufficient to offset the cost of cutting. Present indications are that even the cheapest grades of killed steel can be made at least as low a cost in this mold as in standard molds and with a degree of central soundness which is greatly improved over present practices. Furthermore, due to the fact that pipe is entirely removed, it is possible to use solid molds with the small end up and eliminate the stripping difficulties which are inherent with large-end-up molds.

Experiments are now being carried out by rotating the molds in such a manner as to keep a continual pressure from the center to the wings. This not only improves the grain structure but leads to a further reduction in the discard. It also permits much broader and thinner ingots suitable for plate mill work to be made without danger of pipe or segregation forming in the wings.

Unique Forming and Welding Operations

(Concluded from Page 201)

may be bolted on if preferred. After the cover is attached the housing is ready for the necessary machining operations.

In the second method of producing rear axle housings the housing is made from two flat blanks, one for each end half, which after forming are welded with a single longitudinal seam. Heretofore housings produced from flat blanks have been made with two longitudinally welded seams. This new method is claimed to be more economical for making the larger sized housings and the company is using it for the manufacture of several types of housings.

Housings Made from Flat Blanks

Blanks of a developed shape are used. Because of their shape the blanks may be nested in the blanking operation with a minimum scrap loss. During the blanking operation two properly spaced slots are punched in the wider end and these later are opened up to the edge of the blank. The blank is formed into a tube with its smaller end circular in section and the larger end, due to the shape of the blank, oval in cross-section. The two longitudinal edges are brought to-

gether in this forming operation and they are then welded, providing a tube with a large end which is formed without expanding operations. The two slots are located at opposite points and these are now extended to the end of the enlarged end of the tube, dividing this end into a pair of channel shaped arms. This enlarged bifurcated end is then heated to a forming temperature and subjected to two forming operations, one to spread the arms apart into a Y shape and the second to spread them to an accurate shape, thereby forming the forked end of the tube into a section with a semi-circular face to form one-half of the banjo section. These two formed members are welded together to form a complete housing.

The location of the inner ends of the slots in relation to the tapered portions of the blanks is an important factor in the prevention of undue stretching of the metal in the web between the two arms during the forming operation, as the slots are so located that all of the stretch appears in the margins, which are subsequently trimmed off to true up the semi-circular end which forms the banjo.

The brake apron and bearing retainer at the other end of the tube may be either made integral with the housing or formed as a separate part thereof. In the former method, the outer end of the tube is upset and enlarged in the same way as in the tubular type housings. If the brake apron flange and bearing retainer are to be separately attached to the housing, the outer end of each tubular section is swaged down to reduce its diameter, which correspondingly increases the wall thickness and the combined brake apron flanges and oil retainer rings and then welded to the tubular section of the housing halves. An efficient welding set-up is provided for this welding operation.

Arc Welded to Housing

After the two housing halves are welded together and the reinforcing rings are welded in place, the housing is clamped at an angle in a rotary jig and as the housing revolves in this jig the combined part is arc welded to the housing with a circumferential weld on the inner side, at one end of the housing, while the outer end of the duplicate part at the other end of the housing is welded by a second arc. The housing is then swung end to end and the flange attaching operations are repeated, the housing leaving the machine with these parts attached to the housing with circumferential welds at both the inner and outer ends of the attached rings. This welding is done on two duplicate machines set side by side and attended by one operator. After the housing is completed with the end of the tube formed in either way it is trued under heavy pressure in a finishing die and is then ready for subsequent machining operations.